

SCUBAPRO®

Display Until 5/13

\$2.50

CANADA

\$2.95

Spring 1996

# SCUBAPRO® Diving

**Sinking Treasures...**

**What a Blast!**

**Discover the Red Sea After Dark  
Atocha, the Moment of Discovery**

**& Snorkeling**

**Diving With Sea Otters**  
**More Diving Trivia**

**AF** An Aqua-Field Publication

TOP-FLITE

XL  
TOP-FLITE

# STILL THE LONGEST BALLS. NO MATTER WHERE YOU PLAY 'EM.

Off the tees.

Off the fairways.

From the hallowed links of St. Andrews, to the scenic vistas of Pebble Beach, you'll find that Top-Flite® and Top-Flite XL® are still the Longest Balls in golf.

It's no accident.

We're continuously improving our cover and core to ensure that the low-boring Top-Flite and the higher-flying XL go just about as far as the law allows.

And the proof is in the testing.

Using drivers and five irons in the hands of average golfers (golf isn't a game played by mechanical testing machines just yet, thank

## THE TOP-FLITES

Beat Tribest PT	13.6 yards
Beat Tribest DT	10.8 yards
Beat Pinnacle	2.7 yards
Beat Tribest 384 Tour	7.2 yards
Beat Dunlop DDH	9.1 yards
Beat Wilson Prostaff	13.3 yards

In distance tests with golfers measuring the combined totals of drives and 5 irons, Top-Flite and Top-Flite XL beat the other leading balls. For complete test results, write: Spalding, Dept. TF84, Chicopee, MA 01013.

you), Top-Flite and Top-Flite XL, for over 10 years have outdistanced the competition.

And now Spalding gives you another Longest Ball to choose from.

## INTRODUCING THE 492-DIMPLE TOP-FLITE PLUS.®

If dimples mean distance, then Top-Flite Plus is the new distance champ.

Just as long as a Top-Flite but with a thinner Surlyn,™ no-cut

cover, Top-Flite Plus is aerodynamically designed to carry longer.

It's the Longest Ball for the golfer who likes to work the tightest greens.

So if you want distance, you've got three ways to go.

And they're all Top-Flites.

# THE LONGEST BALLS. SPALDING®



# You're just hours away from becoming a better bass fisherman.

Ever wished you could spend a few hours with a top bass pro as your private instructor? With these video tapes, you're there, on the water with Ricky Clunn, Al Lindner, and Roland Martin. See why they're so successful. Learn their proven techniques, favorite lures, and fish-finding tactics.

No matter how long you've been a bass angler, each tape will show you techniques it would take years to learn on your own. And you can watch these tapes when you want, as often as you want, season after season.

**Bass Fishing: Top To Bottom** features Ricky Clunn, the only back-to-back Bass Masters Classic winner. Ricky shows you how to read a lake and find the bass. Look over his shoulder, up close, to watch his presentation and lure retrieve techniques. Learn to recognize bass feeding patterns and take advantage of them. Ricky explains how understanding seasonal changes, weather, surface temperature, and light intensity will make you more successful. In just one hour, he answers the questions you've been wanting to ask about bass fishing. \$79.95.

The pro's have long realized the key to catching more and bigger bass is to understand their needs and environment. **Bigmouth** takes you below the surface in the private world of the bass to better understand the behavior and temperament which make catching big bass such a challenge. Glen Lau, an award winning cinematographer, turns underwater photography into art for 50 minutes as you follow the bass' entire life cycle. It's a fascinating look at the beautiful, but often violent world of the bass. You'll see proof that big bass will hit almost anything that moves while protecting their nest or when hungry. Watch as they take on all intruders and relentlessly stalk a variety of prey, including young ducks, to satisfy their hunger.

Fourteen months in the making, edited from literally miles of film, **Bigmouth** will force you to rethink your bass fishing methods. \$89.95.

These information-packed video tapes are the biggest breakthrough in bass fishing since electronic fish locators. Also available are these 30 minute videos for \$59.95 each: **Feeding Habits of the Bass, Bass in Heavy Cover, Smallmouth Bass and Surface Lures and Buzzbaits.** If you already own a VCR, why wait?

To buy or rent, visit your local tackle or video store, or if they're not available, order them directly from 3M. Available in VHS and Beta.

To place your order or to receive a FREE brochure detailing the entire series of fishing and hunting tapes in **The Sportsman's Video Collection**, write us at Scientific Anglers, 3M Center, St. Paul, MN 55144. Dept. AQF.

**Scientific Anglers**  
3M Center, St. Paul, MN 55144



3M hears you.

**3M**

# SCUBAPRO

# Diving

# & Snorkeling

## Contents

- 6** Editor's Page
- Nancy Sefton 8** Breathtakingly Beautiful  
Special tips for snorkelers who want to take great underwater photos.
- Gary Gentile 12** Strippin' & Dippin'  
The right way to preserve your treasures from the deep.
- Carlos Eyles 16** The Art and Ethics of Spearfishing  
Breath-holding techniques are covered in the conclusion of this three-part series.
- Cathie Cush 22** Mullica Stew  
Divers search the murky waters of a New Jersey river for Revolutionary War wrecks.
- Steve Rosenberg 26** Sea Otters, Cute But...  
America's answer to the Koala is stirring up California waters.
- Lou Fead 30** VIVA the New G250!  
A look at Scubapro's new second stage that offers durability and complete breathing control.
- Mavis Hill 34** Celebrity Seafood Sampler  
Top names in diving offer their favorite recipes.
- M. Timothy O'Keefe 36** Islands Lost to Time  
Divers find as much to see onshore as off in the Galapagos Islands.
- Francis LeGuen 40** Flirting With Folly  
French divers face alligators to film fossils.
- Dee Scarr 44** She Shoots Sea Shells  
How to collect unusual shells on film.



Photos by Gary Gentile

Illustration by Steve Spears

# THE MAGAZINE FOR ACTIVE DIVERS

## SCUBAPRO® Diving & Snorkeling

### PLEASE CHECK YOUR CHOICE

- ☐ 4 ISSUES FOR \$10.00  
☐ 8 ISSUES FOR \$18.50  
☐ 12 ISSUES FOR \$25.00

RATE GOOD IN U.S. ONLY. FOREIGN RATE ADD \$ 50 PER ISSUE

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_

ZIP \_\_\_\_\_

☐ PAYMENT ENCLOSED

☐ CHARGE MY: MASTERCARD ACCT. # \_\_\_\_\_

VISA ACCT. # \_\_\_\_\_

EXP. DATE \_\_\_\_\_

SIGNATURE \_\_\_\_\_

Eric Hanauer

**72**

## From Start to Fin

There's more to making a Jet Fin than meets the eye.



## Ant of Discovery

Experience the thrill of 1 riches.

## Trivia Quiz

## After Dark

Best dive site presents

## De to Dubious Denizens of the Deep

## asures

creating an underwater florida coast.

## Surfaces From Oil Flow Below

natural oil seep off the





# SCUBAPRO Diver

## Contents

- 6** Editor's Page
- Nancy Sefton 8** Breathtakingly  
Special tips for snorkeling  
great underwater photos
- Gary Gentile 12** Strippin' & Dip  
The right way to preserve  
the deep.
- Carlos Eyles 16** The Art and Et  
Breath-holding technique  
conclusion of this three
- Cathie Cush 22** Mullica Stew  
Divers search the murky  
river for Revolutionary War
- Steve Rosenberg 26** Sea Otters, Cu  
America's answer to the  
California waters.
- LOU Fead 30** VIVA the New G250!  
A look at Scubapro's new second stage that  
offers durability and complete breathing control.
- Mavis Hill 34** Celebrity Seafood Sampler  
Top names in diving offer their favorite recipes.
- M. Timothy O'Keefe 36** Islands Lost to Time  
Divers find as much to see onshore as off in  
the Galapagos Islands.
- Francis LeGuen 40** Flirting With Folly  
French divers face alligators to film fossils.
- Dee Scarr 44** She Shoots Sea Shells  
How to collect unusual shells on film.



Photos by Gary Gentile

Illustration by Steve Spears

orkeling



**Robert Weller 46**

**Atocha . . .**

### **The Moment of Discovery**

Few men will ever experience the thrill of discovering untold riches.

**48 SCUBAPRO Trivia Quiz**

**Dee Scarr 52**

### **The Red Sea After Dark**

One of the world's best dive site presents Act II at sunset.

**Cathie Cush 54**

### **A Field Guide to Dubious Denizens of the Deep**

**Yvette Cardoza and Bill Hirsch 58**

### **Sinking Treasures**

Artificial reefs are creating an underwater paradise off the Florida coast.

**Bruce Watkins 68**

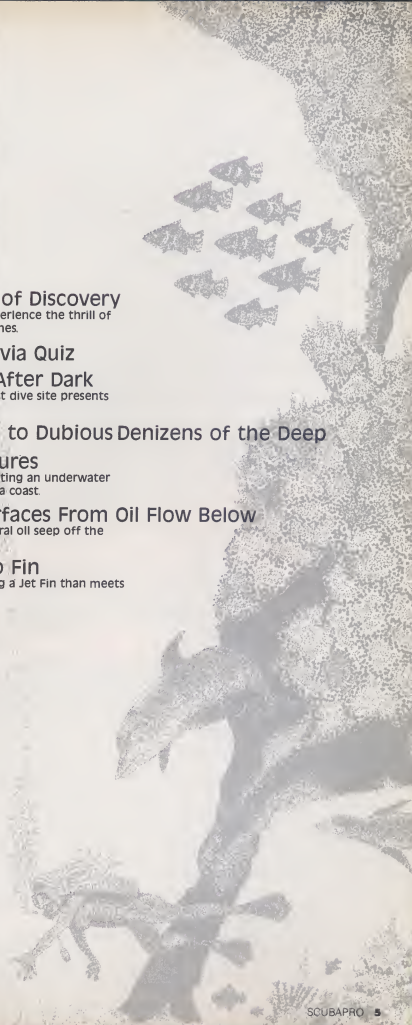
### **New Data Surfaces From Oil Flow Below**

Scientists study a natural oil seep off the California coast.

**Eric Hanauer 72**

### **From Start to Fin**

There's more to making a Jet Fin than meets the eye



## SCUBAPRO DIVING AND SNORKELING

Stephen Ferber  
**Publisher**

Edward Montague  
**Project Editor**

Anita Schettino  
**Design**

### AQUA-FIELD PUBLICATIONS, INC.

STEPHEN FERBER

President

JUDITH HEMION

Administration Director

STAN MESEROLL

Editorial Director

ANITA SCHETTINO

Art Director

EDWARD MONTAGUE

Executive Editor

KATE DAVIES

Senior Editor

LAURIE K. DOYLE

Assistant Art Director

DOROTHY BRITAIN

Art Associate

MARY LASKO

Financial Services

### Circulation Consultants

IRWIN E. BILLMAN

RALPH PERICELLI

Magazine Communications Consultants

P.O. Box 277

Tulalame, N.Y. 10707

(914) 337-6822

### The Longshore Group, Inc.

603 Martha Street

Montgomery, AL 36104

(205) 263-6050

Advertising Representatives

Cover photo of the sinking of the "Ultrafreeze" off Miami,

Florida, by Pat Canova

All photographs, unless otherwise credited, are by the

authors

Spring 1988

SCUBAPRO Diving & Snorkeling is published four times a year by Aqua-Field Publications, Inc., 656 Shrewsbury Avenue, Shrewsbury, New Jersey 07701. All rights reserved under International and Pan American conventions by Aqua-Field Publications, Inc., Stephen C. Ferber, President. The contents of this publication may not be reproduced by any method without the prior written consent of the publisher. Copyright © 1985 by Aqua-Field Publications, Inc.

The contents of this publication, including especially diving techniques and the use of diving equipment, reflect individual experiences of the writers and are not necessarily the recommended practices of SCUBAPRO, a Division of Under Sea Industries, Inc. Neither SCUBAPRO nor Aqua-Field Publications, Inc. and its contributors shall be liable for any mishap claimed to result from the use of such material.

SCUBAPRO strongly recommends anyone interested in learning to scuba dive seek professional diving instruction in a program certified by one of the national organizations.

Manuscripts and artwork submitted to Aqua-Field Publications, Inc., should be accompanied by self-addressed envelopes and return postage. All contributions receive consideration, but the publisher assumes no responsibility for material submitted. National editorial office: Aqua-Field Publications, Inc., 656 Shrewsbury Avenue, Suite One, Shrewsbury, New Jersey 07701, Telephone (201) 842-6300.

## Editor's Page

Pat Canova's cover photograph dramatically records the placement of another new wreck divers will enjoy for many years to come. Florida's artificial reef program is probably the most energetic in the country and one to be emulated by other coastal states. Yvette Cardoza and Bill Hirsch have taken a close look at what is becoming a fierce competition among coastal counties for every available derelict ship. Their article begins on page 58.

Wreck divers who haunt more traditional sunken vessels in search of artifacts will find very specific information on how to preserve their treasures in Gary Gentile's article on page 12. Gary is an authority on wreck diving and a real expert on halting the corrosive action of salt water.

Some divers have a knack for getting themselves into a tight squeeze. Last year we followed Francis LeGuen to the deepest reaches of an underwater cave in Australia. He quit only when he couldn't squeeze himself through a tight passage. In this issue, Francis recounts his adventures diving in an alligator infested Florida spring in search of mastodon bones in a deep cave. No wonder he's the youngest member of the French Explorers Club. Francis' article begins on page 40.

On a tamer note—but certainly as exciting—is Robert Weller's account of the final days leading up to the discovery of the fabulous treasure of the *Atocha*. Although much has been reported on the value of the find, the events surrounding the actual discovery are fascinating. Bob's article begins on page 46.

For those not planning a diving trip to warmer climates, we know you'll enjoy this winter issue of Diving & Snorkeling and it will help speed the arrival of spring and a new diving season.

*Edward Montague*

Illustration by Steve Spears





# BLACK Lightning

Since its introduction in 1965, the legendary Jet Fin has had such impact on the power fin market that it has been copied in one form or another by nearly every fin manufacturer. Their designs or materials have never performed like the original Jet Fin which offered maximum propulsion with minimum effort. A technically advanced rubber compound was introduced in 1982 which added greater efficiency by reducing the overall weight of the fin without affecting the superior thrust and snap back qualities of the new Lightning Jet Fin. Stop in at your Scubapro dealer and try a pair of Lightning Jet Fins and don't be surprised if he has some Jet Fins still in rental that are over 15 years old. They still perform like new. Lightning Jet Fins for the serious diver.

**SCUBAPRO®**

3105 E. Harcourt, Rancho Dominguez, CA 90221

100-page Equipment Selection Guide and Scubapro Diving Adventure Magazine available at Scubapro Dealers

## JET FINS...STILL THE ONE



Hermit crab

# Breac

Snorkelers  
can take super  
underwater  
photos.

Schooling grunts

Juvenile anemone with cleaning shrimp



emphasis in print, films and camera ads would indicate scuba is essential to getting great underwater pictures, but don't believe it.

In the 70s someone finally considered the snorkeler and brought out a submersible 110 Instamatic with a built-in flash. It works quite well above 15 feet. This was followed by slightly more sophisticated models that accommodate 35mm film and can be used even deeper. Fine, if you're content with snapshots.

Can a mere snorkeler aspire to something more? And what of scuba photo fanatics who twiddle their thumbs impatiently during long surface intervals? They could be happily snapping away in the shallows, getting photos anyone would be proud of.

coral clump was a juvenile sea anemone looking much like a white chrysanthemum. A cleaner shrimp decked out in blue, purple and white danced among its tentacles. I stopped kicking. From under the same nondescript lump of coral, a pair of ragged antennae waved; they belonged to an adolescent spiny lobster.

Further inspection revealed that every small coral outcrop on the shallow bank supported a mini-menagerie within arm's reach as I was still on the surface. Suddenly the tank was a burden. So much for scuba. We returned to shore, stashed the tanks, and geared up for macro photography.

Several years later I was wading out to a drop-off on the Sinai coast, wondering why I should bother with a tank at all.

# thtakingly Beautiful

BY NANCY SEFTON

**W**ho said scuba divers have more fun? Snorkelers can just as easily experience all of the joys and frustrations of serious underwater photography. True, the

Nancy Sefton is a free-lance writer and underwater photographer who has lived on Little Cayman Island for the last 14 years.

With a little patience, practice and dedication, snorkelers can achieve satisfying results using a full range of equipment and lenses, from macro to the super-wides. Basic requirements are the right area, the right conditions and the right equipment. If water is more than two feet deep, good free-diving skills come in very handy too.

My first experience with snorkeling photography occurred one day as my buddy and I, wearing tanks, kicked over the shallows toward a deep offshore reef at Roatan. In only two feet of water something caught my eye. Protruding from a

Carefully I sidestepped juvenile anemones with their baby clownfish, in water only knee deep. I remember spending all of my surface intervals creeping over the shallows, photographing just about every type of animal in its juvenile stage, that calls the Red Sea home.

In the Caribbean, some of my most prized shots were taken while snorkeling. I've found an adolescent octopus in its conchshell home, busy prying open a scallop; I've photographed a rare chain moray eel up against a steep, rocky shore; I've stalked stingrays, 'cudas, schools of squid and even young nurse sharks in waist-deep waters.

The snorkeling photographer is free to explore at his or her own pace. There are no deadlines; one is unhindered by considerations of air supply, time and depth.

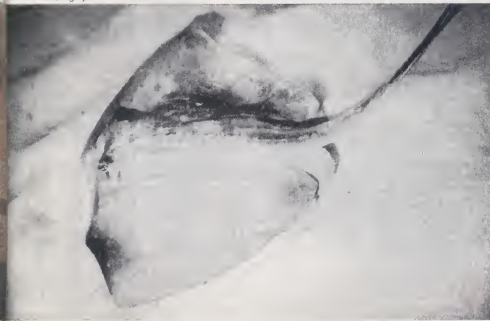
Tropical and semi-tropical waters are best for snorkeling photography; but by no means should one rule out colder seas with their profusion of colorful, shallow-water marine life. Ideal conditions in any ocean include lack of strong currents and surge, relatively calm water, and for wide-angle work, good visibility.

While there is no lack of interesting subjects at snorkeling depths, there are certain problems to be overcome. First, it pays to increase your lung power if you want to pursue subjects that lie deeper than an arm's reach from the surface.

Skilful free divers can meander along a 30- or 40-foot bottom looking for subjects, and shoot them quite leisurely, all on one breath. Most of us, however, have to settle for shallow subject matter.

First scan the bottom from the surface, and choose your subject. Complete all

Stingray



necessary camera settings before you kick downward. A weight belt will help you stay down long enough to get the shot. If you have a free hand, it helps to grasp something solid on the bottom. Those who don't know the stingers from the benign, should definitely wear gloves.

Bright, sunlit barrier reefs are perfect for wide-angle subjects, particularly where there are large coral formations which often include elkhorns and soft sea whips and plumes with fish and other snorkelers to pose near them.

An underwater flash is rarely necessary at these depths; ambient light is often strong enough to overpower the effect of a strobe. Unless illuminating areas in shadow or to bring out colors, rely on that big strobe in the sky, and use it to your advantage.

Unless the sun is directly overhead, for

matic exposure, use a light meter. Even in the shallow water, determining available light exposures can be tricky, especially for divers used to the lower light levels of scuba depths. It is usually practical to make one dive solely for meter-reading. Back on the surface, preset the exposure and dive once again for the shot.

Considering the brightness of shallow areas, slower films, with a speed of ASA 64 and 100, work very well. Overcast conditions or less than very clear water may require faster films with ratings of ASA 200 and 400.

Many subjects, such as stingrays, flounders and other bottom-huggers lie against white sand. Be careful. Sand is a troublesome background because it reflects both sun and strobe light. Your shots will be overexposed unless you compensate for this by closing down the aperture.



Christmas tree worms

best results, place your back to it when you shoot. In this way, the sun will shine onto your subject. If you shoot against the sun, the picture will appear hazy, lacking color and contrast.

Another important rule of camera angle applies to both snorkelers and scuba divers — get low and shoot upward. Branching corals, both hard and soft, fish and other snorkelers look far more dramatic against a bright surface as background. Test this rule of shooting downward from the surface; then, dive to the bottom and snap the same scene using an upward angle. You'll be surprised at the difference.

Fish are seldom easy to capture on film, even with the help of scuba. Snorkelers should watch for the small, bright schools of fish that often throng around barrier reefs. Schooling fish are usually easier to approach than solitary ones; they've learned there's safety in numbers.

If your camera does not have an auto-

For macro photography, artificial light is, of course, a must. A lightweight system that follows the K.I.S.S. rule: Keep It Super Simple, is best. An easy to handle camera with 35mm or 28 mm lens, and the appropriate extension tube and framer will do.

The tube fits between lens and camera, effectively moving the lens elements farther from the film plane. The result is simple close-up capability. A three-sided framer, fastened to the tube, sets the exact lens-to-subject distance and picture area.

The exposure, distance and shutter speed settings used are constant. Most close-up systems call for the smallest aperture opening (f22), a shutter speed of  $\frac{1}{500}$ th second, and a present minimum lens distance. All that's required of the photographer, is to find the right-sized subject, place the framer around it, and shoot.

A system that includes a small, narrow-beamed strobe fastened to a camera bracket in the proper macro position, is

easily manipulated with one hand, leaving the other free to hold the bottom. By using new batteries or a fresh recharge, the fast recycle time will allow you to take several shots on the same breath.

A surprising variety of macro critters live close to the surface in seas both warm and cold. In the Caribbean, flamingo tongue snails, Christmas tree and leather duster worms, hermit crabs, nudibranchs and even coral polyps are ideal subjects, all at home in waters 15 deep or less.

An "eye" for good pictures is the one magic ingredient in this recipe for successful snorkeling photography, and it's not easy to come by. Only by experience can you learn where to find the obscure, the cryptic, the non-descript. Fascinating animals that every photographer dreams of capturing on film are literally at the fingertips of those snorkelers who know where to find them.

I've watched countless divers pass blindly over so-called barren shallows, oblivious to what lies just inches away. Transparent tentacles extend from beneath an algae-encrusted rock, almost unseen, four peppermint-striped antenna wave among the tentacles, advertising the presence of a mated pair of red pistol shrimps living symbiotically with a corkscrew anemone.

Another rock, overturned gently, reveals brilliant purple encrustations against which two juvenile sea urchins compete for living space with three brittle stars and a tiny blue crab. This is macro heaven! Always return rocks to their original positions on the sea floor or you spell the demise of those animals harbored beneath them.

From its home in a tiny coral crevice, a juvenile moray eel surveys a passing parade that includes pufferfish, schools of yellow grunts, sluggish peacock flounders, an occasional octopus uncharacteristically hunting by day.

The snorkeler, drifting silently overhead does not disturb the creatures below. A four-foot barracuda passes, hugging the surface, accompanied by some two dozen young bar jacks. Suddenly these hangers-on abandon their natural host and swim over to adopt me instead. The cuda, jealous and indignant, sneers and turns tail. Confused, the fickle jacks follow. They know where their fortunes lie.

I pause to stand a moment, waist-deep, and survey the shimmering sea spread around me. There's movement below. A large grey stingray has sidled up to my fins to inspect them. But I'm only a distraction. He turns his shovel nose and glides away.

Next time the opportunity presents itself, try some serious photography without scuba. You'll discover a new pursuit, a new challenge, and a whole new world of subjects for your camera.

S

NEW FOR '86



## The most powerful lantern ever created.

It's an absolutely brilliant innovation in lantern technology. The first portable lantern ever to achieve a full 300 candlepower.

The new Coleman® Powerhouse.

It's nearly twice as powerful as the brightest propane lantern. And 35% brighter than any other liquid-fuel lantern Coleman has ever built.

The brightness is adjustable, too. Just turn the dimmer control to change from floodlight brilliance to a candlelight glow.

The twin-mantle Powerhouse offers a new no-fuss lighting system, burns up to 14 hours on one fill-up of Coleman fuel, and is more economical to operate than propane lanterns.

The Powerhouse. It's lightyears ahead.

For a free color brochure on this and other Coleman products, write: Coleman; Box 1762; Wichita, KS 67201.

**Buy it now, and get a \$5 REBATE.**

**Coleman®**

We outfit your outdoors.





BY GARY GENTILE



Stern helm is hoisted from a wreck after 40 years of submersion. Jon Hulburt inspects brass cover of bollard on World War I wreck.

# Strippin' & Dippin'

**W**hile many nautical artifacts found in homes and stores have never known the destructive environment of the sea, those items recovered from underwater — especially salt water — may be in a condition undesirable to the finder, or unstable

when removed after many years of submersion. For this reason it is necessary to differentiate between restoration and preservation.

Restoration, like beauty, is in the eye of the beholder. To some, only highly polished brass that gleams with its original, manufactured finish, is desirable. To others, the green patina resulting from oxidation of the copper content lends an air of the sea, and is preferred. Be that as

it may, restoration is served and all are content.

Preservation, on the other hand, is not so arbitrary. Some materials are radically affected by saltwater immersion and must be gradually brought back to a stabilized condition. Unless treated, wood will shrink and split, leather will twist and wrinkle, and iron will crumble into an unrecognizable pile of junk and dust.

Backyard treatments are available as

Gary Gentile is a lecturer and free-lance writer with extensive wreck diving experience including dives on the Andrea Doria.

are the tools, chemicals, and safety measures necessary to bring one's nautical antiques to the desired state of preservation and restoration.

Water, although described chemically as a universal solvent, can also act as a universal preservative. Whenever artifacts of any material are recovered from sea water they should be stored in fresh water (tap water will do) until the necessary treatments can be administered. Objects can so remain indefinitely without further damage until you gather the materials and have the time to do the job.

### Brass and Bronze

Brass is an alloy of copper and zinc and has a yellowish tint. Bronze is more reddish in color and is basically an alloy of copper and tin, with other metallic substances, especially zinc, added in small quantities. The percentage of mixture is variable.

Brass and bronze are highly resistant to corrosion, which makes them ideal for ship furnishings and working parts. The green patina often seen — the bane of many a sailor — is a thin layer of natural oxidation, called verdigris, which does not damage the underlying molecular

water. This not only cuts down the strength of the acid while stretching its usage, but goes easier on the brass object. Gently put the artifact into the acid, while holding your breath. It will start effervescing immediately. If the object is not covered fully, add more water. Then clamp down the lid.

Most marine growth will be dissolved or loosened in a day or two. Hard corals will require more time. It is better to use more time than stronger acid in order to prevent the surface from pitting. Also, if the object is not fully covered the fumes will create a green line where the liquid ends. This will be impossible to remove, even with further soakings.

After use, the acid may be stored in plastic jugs. It is still usable as long as it bubbles when encrusted artifacts are put in it. When exhausted either spike it by adding more acid, or dispose of it by pouring it down an outside drain and flushing it with water.

A dive buddy once called in a state of near panic. He had acid dipped a port-hole, polished it and hung it on his living room wall — all within a span of a few days. Within a week it had turned completely green! An unsightly and pungent

powdery consistency must be used. A larger grain sand, such as beach sand, will seriously pit any smooth surface and should be avoided. But, by using a tent or blasting against a wall on a thick tarp most of the sand can be reclaimed and used over.

Polishing can be done with either double-aught steel wool and gobs of elbow grease, or a fine wire wheel on a reversible drill. Why reversible? After a few minutes of polishing the bristles get bent backwards so the cutting edge is dulled. Reversing the rotation increases the abrasiveness by pointing the tips of the bristles forward.

You can either stop here, or go one of several ways. For a gold-like, highly reflective surface, apply buffing compound and burnish it in with a soft wheel. You will end up with a museum piece. For that "at sea" look, a short soak in vinegar will give a slight greenish tinge.

In either case, you might want to add several thin coats of clear acrylic, best applied from a spray can. This will seal the finish, prevent further oxidation, and allow handling without leaving grease prints or smudges which are almost impossible to remove once they are im-

## A salvager's notes on preserving treasures from the deep.

structure. Brass and bronze, therefore, do not need to be preserved when recovered from the sea, but merely restored to a condition deemed suitable to the collector.

Usually, the only thing to happen to brass or bronze underwater is that it collects a veneer of sea growth including coral, barnacles, anemones, and various forms of plant life. To rid objects of these smelly encrustations requires nothing more than a slow dip in muriatic acid. This is a commercial grade, 20 percent solution of hydrochloric acid (HCl) and can be found in hardware stores or wherever swimming pool accessories are sold as it is also used as a pH adjuster. It usually comes in one gallon jugs. If larger quantities are needed locate a chemical outlet or brickyard and purchase it in carboys containing about 20 gallons. The cost will be significantly lower. A word of caution: muriatic acid is a strong and dangerous corrosive. When handling it, wear rubber gloves and always use eye protection: a plastic face shield, or goggles, or both. And be careful not to inhale the fumes.

A plastic container, preferably with a lid, should be placed outdoors in a well ventilated area that can be cordoned off from children. Pour the acid into the container and add an equal or double amount of

powder had formed on the surface and this was gradually flaking off onto his new carpet.

The chlorine from the muriatic acid was leaching through the porous material and forming chlorides. The same will happen, to a lesser extent, to any piece of brass taken out of salt water and left untreated, as chlorides will form from the salt content — remember that sea salt is sodium chloride.

For this reason, all brass or bronze objects should be soaked in fresh water, whether acid dipped or not, for at least a month; more if the metal is exceptionally porous, or very old. The water should be changed about once a week. If this procedure is not followed "bronze disease," as museum people like to call the slow greening process, will occur months or years later and will be difficult to get rid of.

As an intermediate stage for ease in polishing, or for objects too large to soak in acid, sand blasting is recommended. A small sand blasting unit can be picked up at any hardware store or home center, complete with bucket, hoses, and a variety of nozzles. However, a compressor is necessary to operate it. A complete setup may be available for rent by a tool rental company. A fine sand such as double-aught banding sand, or glass bead with

bedded.

Please note that if the freshwater soaking was not long enough, the acrylic will not prevent the artifact from turning green. This is not an effect of exterior oxidation, but of chlorides leaching out from within. The acrylic can always be removed.

Lead, tin and babbitt can be treated in the same manner as brass and bronze.

### Gold, Silver, Copper and Pewter

These metals are lumped together not because of any nearness in composition (the first three are elements, while pewter is tin alloyed with lead, brass, or copper) but because the treatments for them can be used interchangeably. There is, however, an optimum cleaning method for each metal.

Gold is almost always found gleaming like the day it was minted. The noblest of metals, gold is so resistant it will not react with either organic or inorganic compounds — marine growth cannot get a foot in it, so to speak. Occasionally, it may be found stained, or tinged by other metals in the vicinity. Since gold can only be dissolved by *aqua regia* — a mixture of hydrochloric and nitric acids — almost anything can be used to dissolve these slight discolorations. Gold, however, is

also one of the softest metals: it should never be rubbed or scraped with anything more abrasive than a soft cloth or it will scratch.

Silver, when found in chunks such as bullion or conglomerates of coins, is fairly resistant to the ravages of the sea. Exposed surfaces, unless "saved" from electrolysis by the sacrifice of nearby metals, will be in poor condition and cannot be restored. Marine growth can be removed by the acid treatment, although in this case it is better to use the less reactive acetic acid found in vinegar. The solution will effervesce slowly, and you can actually watch the particles break away and float up to the surface. Once loosened, rub the silver object with a nylon pad such as used for cleaning Teflon surfaces. Afterwards, soak in fresh water for a couple weeks to leech out the acidic residue, and brighten with silver polish. On the other hand, if the silver is merely tarnished with black silver sulfide, try rubbing with a paste of water and baking soda.

Copper, unalloyed, is a fairly weak metal which dissolves all too readily in the sea. Natural electrolysis causes a mild electric current which turns atoms into ions, thus losing their cohesiveness. They then float away leaving "holes" in the material. This process cannot be reversed. Strong acid treatments will completely dissolve delicate copper sheet and should be avoided. Vinegar is the only safe method of cleaning other than an electrolysis bath.

Electrolysis is a complicated procedure requiring a plastic tub large enough for the object filled with a solution of five percent lye and 95 percent water. A car battery or battery charger is needed to generate direct current, and a sheet of scrap iron. Using copper wires, connect the object to be cleaned to the negative pole and the iron to the positive pole. Submerge both in the solution, but not touching each other. Wear rubber gloves when submerging the objects and do so before connecting to the battery or turning on the battery charger. An electric current passes from copper (cathode) to iron (anode), ripping loose chlorides from the artifact and depositing them on the scrap iron. Clinging marine growth is jarred free and falls to the bottom of the bath, or is dissolved away. The length of soaking depends on the size of the object and the amount of growth, ranging from hours for coins to weeks or months for something as large as a cannon. The main advantage to this method is that the copper is plated in the process, making it more chemically stable. This procedure can also be followed for any copper alloy, plus silver and pewter.

Pewter on its own is a fairly stable compound. But when leaning against iron, such as a ship's hull, the contact of dis-



Gold leaf embossed cup and saucer recovered by the author from the Andrea Dona

similar metals causes electrolysis in which the pewter is sacrificed. It may appear deeply corroded, or pitted, a condition which cannot be corrected. Pewter is often plated with silver which, because of its thinness, usually dissolves unless the object is covered with silt or sand. In either case, the treatment is one of delicacy.

The object should be soaked in water, as usual, then dried. Next is a simple technique called "flecking." Gently tap the encrustation with a hard tool, such as a screwdriver, to chip off particles. Use the rounded shaft of a Phillips screwdriver rather than the squared edges of a regular shaft so the soft metal is not dented. Also, do not gouge, as with a chisel. Once most of the hard stuff is off, use a wooden pencil to scrape the surface and get into the grooves.

Should this method fail, you can revert to the vinegar treatment. This is fine for just pewter, but if there is still silver plate clinging to the object it will more than likely peel off. Finally, a buffing wheel can restore a high sheen, as can pewter polish. Clear acrylic sprays can be used on all of the above.

### Earthenware, Porcelain and China, Glass

Ceramics, as a generic term, have been around since the dawn of civilization. Basically, a mixture of mud and water which is either dried in the sun or baked in a kiln, ceramics have a rough and uneven surface, although they are sometimes glazed on the outside, a process in which a material called frit (finely ground glass, clay and water) is applied by dipping, spraying or brushing. After being fired the ware is fired and the coating becomes

smooth.

Earthenware, although fired, is generally unglazed. China can have a wide variety of minerals mixed with the clay, every manufacturer's formula being different. It is glazed to give it a smooth, shiny appearance. Porcelain, known as vitreous china, is fired at a much higher temperature which, because of the greater fuel expense, makes it more expensive. It also makes it waterproof.

Glass is merely silicon dioxide — sand — that has been melted, then molded during cooling.

Of all the categories of marine artifacts these are the easiest to clean. Within the time span of naval history, glass and earthenware products are impervious to saltwater, microorganisms, and all forms of marine plants and animals. Although coral and barnacles may grow on them, other than an occasional etching of glass by the secretion of natural glue, the main hazard, as in the kitchen, is breakage.

Heavily encrusted artifacts should be left encrusted in order to lend an air of authenticity. A barnacle or a clump of coral on a glass or dinner plate substantiates the underwater environment from which the object was removed. You can work around them by cleaning adjacent surfaces with soap and warm water, washing with a cloth, or rubbing with a nylon pad.

Orange colored stains, the result of iron oxides from rusting hull plates, can be removed with an application of vinegar or a mild abrasive such as cleanser. Artifacts of this nature can be dipped in muriatic acid without harm — but, be careful of china with gold leaf.

Unlike the inks used to imprint insignias, shipping line crests, and manufacturer labels, all of which are applied before glazing, gold leaf is put on after this protective process. There is not much material in a leaf of gold which has been pounded until its only 1/100,000 of an inch thick. Long submersion in salt water, with its varying pH levels and strong ionic potential, will loosen the adhesive used to attach the gold leaf. Frequently, this will wash off under nothing more than faucet water pressure, leaving only the underlying embossing template to show where the gold leaf had once been.

In this case cleaning can only be done carefully and by hand. A cotton swab dipped in vinegar can be used to scrub close to the gold leaf, while a sponge can be used on the rest of the piece. The gold leaf is usually too delicate to be touched and should be left alone.

The only other caution, again, is the freshwater treatment. Even though the glaze on china and porcelain appears smooth, the surface is in fact very porous when viewed under a microscope. Sea salt permeates the material and, in the

(Please turn to page 76)

# How To Buy A Spinning Reel.

Tear out and take to your tackle dealer.

You should look for a reel with the world's most advanced bail trigger, the QuickFire II. It's easy to reach, easy to open and doesn't break.

You should look for a reel with No-Fail-Bail, a bail spring that will never break—ever!

You should look for a reel with all Graphite/Titanium construction. It's the only material that combines incredible strength with amazing lightness and absolute corrosion-resistance.

You should look for a reel with extra-high speed gear ratios for line-gobbling retrieves.

You should look for a reel with stainless steel ball bearings for smooth, effortless operation

You should look for a reel with a push-button, pop-off Graphite spool.

right in the box on many models.

Best of all, there's a QuickFire II spinning reel for every fisherman—from our top-of-the-line GTX-Plus with three ball bearings, to our new Mark Series with two ball bearings, to our new AX Series with one ball bearing.

Still sound too good to be true? Then head down to your local Shimano dealer and check out a QuickFire II reel. Any QuickFire II reel. Then compare it to the other reels on the rack.

We think you'll get the picture.

"All that in one reel? Impossible."

No, Shimano.

It's a Shimano QuickFire II™ spinning reel—any one of 15 different models in five new series for 1986.

They are the *only* reels in the world that offer all the above features—and more. Like our exclusive Fightin' Drag™ system and a free spare spool packed

 **SHIMANO®**  
TOMORROW'S TACKLE TODAY

low water are equal to those in deeper waters. Often shallow water will yield fish that tend to be cleverly camouflaged, such as halibut and flounder or "hiders" such as croaker, perch and sand bass. Other shallow water fish are highly alert and quick to respond to intruders. But, as has been previously discussed, the student of spearfishing knows that by being a patient and careful observer, the fish will reveal the best method to stalk it.

While relaxation is the major influence on the length of one's bottom time, breath holding cannot altogether be dismissed. Hyperventilation is a subject covered extensively in basic scuba courses and is strongly discouraged. However, free div-

When the need for air signals your dive is over, ascend quietly and easily. Avoid rushing to the surface and popping your head out of the water. Round off your ascent into the floating position and clear your snorkel. Stay relaxed, don't try and recapture your breath all at once. Breathe deeply as you would were you about to fall asleep. Rounding off your dive also allows your eyes to remain fixed on the underwater terrain. The fewer visual breaks you have with the environment, the easier it is to sustain your concentration on it.

The underwater world is forever swaying to the rhythm of its surges and current. Seaweed, eel grass and kelp often ob-

# The Art and Ethics of Spearfishing

BY CARLOS EYLES

**T**here is the long held myth that a free diver's lung capacity is the principle factor in determining his bottom time. Some also believe lung capacity separates the good spearfishermen from the bad. The latter isn't true — neither is the former.

A free diver's ability to relax in the water has a greater influence on his bottom time than the ability to hold huge quantities of air in his lungs. Relaxation is the key. Subsequently, beginning spearfishermen should hunt in water where he or she is both psychologically and physiologically comfortable. A place where the mind can fully concentrate on the job at hand and where the diver doesn't have to struggle to the surface after every dive, gasping for breath.

The opportunities to spear fish in shal-

lowers may use a form of hyperventilation as an aid to extend their bottom time. By inhaling more deeply and exhaling more fully than normal for a period just before the descent, the diver can reduce the level of carbon dioxide ( $\text{CO}_2$ ) in the bloodstream and maintain a longer breath hold. Voluntary hyperventilation should be approached with caution. There is no hard and fast rule concerning the number of inhales and exhales before making a dive that would be within the boundaries of safety. It varies from individual to individual. Each diver must monitor himself or herself. I recommend no more than three inhales and exhales. If you become the slightest bit dizzy with three hyperventilations, you have exceeded your capacity. Stay well within your limitations, and discover your breath-holding capacity by easing into it. Once it is known, relaxation and confidence comes as a natural by-product.

Body movement consumes oxygen. The more efficiently you move in the water, the slower your oxygen will be depleted. Thigh muscles are our body's largest muscles and using them requires the most oxygen. By limiting heavy muscle activity whenever possible, you can improve your bottom time. To do so, keep underwater kicking to a minimum and glide whenever you can. If you are using a wet suit and a weight belt, be sure you are weighted properly. Too much weight or too little has the diver working hard to either keep from sinking or struggling to make a surface dive. Your area of neutral buoyancy should be at or near the midpoint of the depth you are working.

score fish holding caves and holes that are spotted at the end of a dive and then become lost once eye contact with them is broken. When a cave is discovered and you leave it for an air recharge, keep your eye fixed on its surroundings. If it becomes obscured or is deeper than the visibility permits, create a visual trail using fixed objects such as boulders, reef points, prominent kelp stalks — anything your eye can follow to the surface. Try to never break eye contact with the trail while you are resting on the surface. When you are ready for another dive, follow your trail down to the target.

The beginning spearfisherman should review his previous dive while resting on the surface. How was my descent? Did I make any noise? Did I have my speargun in position? Were my movements smooth? Was I comfortable? If I spooked fish, why? Seek to improve your technique. Develop habits that will lead to making the perfect dive each and every time. Spearfishing leaves little room for error — as you will no doubt learn — and good habits lead to good instincts, which in turn lead to fish on the table.

One can have the best technique and equipment and all the knowledge that can be acquired, but if the hunter has not learned to really see the ocean environment, he'll never be a spearfisherman. Essentially we have only our sense of sight to aid us in the underwater environment. The primary rule of spearfishing is to be able to see the fish before it sees you. The diver's eye must penetrate the busy, entangled world that lies beneath the surface and separate the fish from its place of

Carlos Eyles was born and raised in Hawaii. He is the author of two books on diving, "Diving Free," and "Sea Stalking," and a new book, "The Last of the Blue Water Hunters."



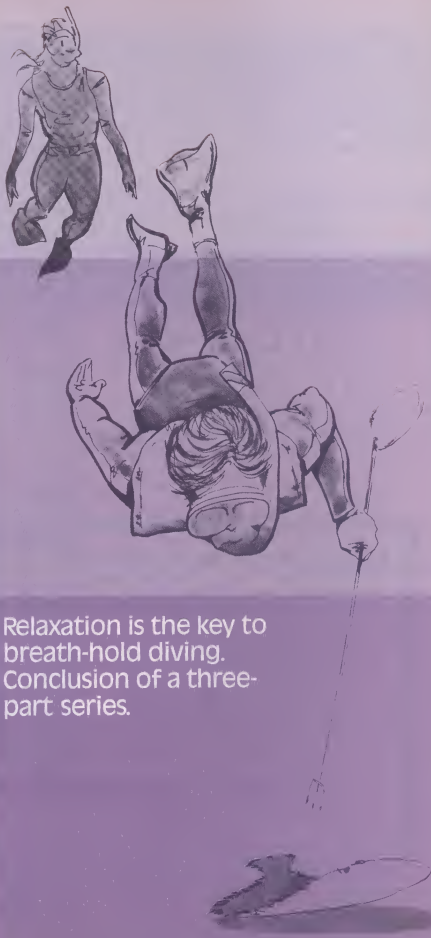
concealment. Part of a tail protruding from a cave, the top edge of a dorsal fin rising above a seaweed encrusted rock, a shadow that does not fit into the seascape, the quarter inch of exposed tail slotted between a gathering of kelp leaves cannot escape the eyes of spearfishermen. First find the fish, then technique will allow you to get close to it.

Unfortunately for a great many divers, a large portion of the undersea world passes beneath their eyes without ever being seen, perceived or understood. There are several reasons why this occurs. As land-based creatures we are able to incorporate all our sensory assets to perceive an object or event. We depend on all our senses to confirm what we think we see. We are lazy lookers. When we enter the world of the ocean which demands a focused attention, we are unable to fully utilize the power of our sight. We see the obvious, those images that jump out and are easily visible. Our eye catches movement and color if it's obvious enough. But this is not enough for the spearfisherman. He must see the subtle, the camouflaged, the hidden.

Seeing the ocean environment with a sharp eye has to be learned. Our eyes function best when we are free of any tension which is another reason to dive in water where we are comfortable. Face masks have a tendency to block off peripheral vision, thus restricting the diver's view of the ocean to what lies directly in front of him. An underwater hunter can substantially increase the area of his vision by slowly moving his head from side to side in the "no" gesture. When the head and eyes are in constant motion, it keeps the diver more attentive and alert, preventing the misdirection of attention that comes with staring. Often we are so anxious to see, we try too hard and end up staring and not seeing anything but the obvious.

To be successful, the spearfisherman must learn to read what I call "the subtle ocean world." This difficult world to see, is equally difficult to describe. It conceals itself in intricate details, in camouflage, and in a general moving busyness that the untrained eye is unable to capture. It is a world constantly altered by visibility, water temperature, tides, currents, surge and external weather conditions. The best method I know to initially recognize and study this subtle ocean is to observe a healthy tide pool.

A lush tide pool is a microcosm of the ocean universe and is the ideal place to learn about the hidden world of the ocean. Once a tide pool, rich in sea life, is located, just sit down facing the sun so you won't cast your shadow across the pool. This is a lesson in itself about the influence your presence has on the environment, even a tide pool. Remain still



Relaxation is the key to  
breath-hold diving.  
Conclusion of a three-  
part series.

# California Channel Islands



For a "FREE" calendar of diving trips aboard  
TRUTH and CONCEPTION  
send a self-addressed, stamped envelope to

## "TRUTH"

Sea Landing Breakwater  
Santa Barbara, CA 93109

# NAUI COLLEGE

## YOUR ASSURANCE OF PERSONAL PROFESSIONAL TRAINING

Whether you desire a full time career as a professional sport diving instructor or want to develop your advanced level skills... consider NAUI College.

- A maximum student / teacher ratio of 6:1
- A supportive staff of professional educators led by Jim Hicks, one of the industry's top minds
- Free full-time placement assistance and business consultation for graduates
- An esteemed roster of alumni worldwide

If you are looking for an intelligent and straightforward approach, call collect or send for information.

Please send me your catalog.

Name

Address

City  State  Zip

NATIONAL ASSOCIATION  
OF UNDERWATER  
INSTRUCTORS COLLEGE  
2400 West Coast Hwy, Suite M  
Newport Beach, CA 92663  
714/ 631-4282

All courses approved by the Superintendent of Education. Approved for V.A. benefits. Financing available.

and look into the pool as though it were the ocean and you were diving. Quickly identify all that crosses your eye and then just observe the pool with an open mind and eye. In a short time your eye will begin to pick up hidden objects and sea life. Camouflaged fish will materialize, crabs and other moving creatures will appear, previously unobserved niches will reveal still more creatures. Your mind shouldn't interfere with the visual process. Empty it on the first go around to permit new input. Tide pools will reveal hidden worlds existing beyond your first glance. They can teach you how to see.

Seeing the subtleties of the ocean world is more difficult than the tide pool. There is far more going on and you are now in the environment, instead of sitting on the edge of it. The task of observing now becomes formidable. Be patient, this is an ongoing process requiring time.

Once you have spotted a hidden or camouflaged creature, a halibut for example, study it. Give your eye a chance to learn what it is looking for, and keep that image clear in your mind. The next time your eye runs across a barren sandy bottom it will have a sharp mental image that will recognize a slight bump in the sand when it appears.

Spearfishing has frequently been condemned over the last decade and a half. Observers who have seen divers kill fish then leave them to rot in the sun or drift to the bottom, dead from a spear wound are justifiably angry. Their efforts to stop spearfishing are not. Spearfishing persists despite the negative outcries because most participants who are true sportsmen. The ocean is a wild kingdom and there is a natural calling to the hunter in man. Spearfishing lifts the state of alertness and observation to a level that cannot be achieved through passive fish watching. From that, an appreciation of each species of fish is realized along with an understanding of how their behavior is affected by changes in the environment. The hunter cannot help but acquire a fair idea of how both the creatures and the environment are interrelated. Also seeing the ocean world from a spearfisherman's eye brings forth a world that is simply not seen by the casual observer.

Yet the hard truth remains — fish are killed. The spearfisherman puts forth a great deal of time and effort and wants to be rewarded. He wants fish. It is at this point a question must be raised and a decision must be reached. Am I a killer, or am I a hunter? The hunter takes only what he can use, and eats all that he takes. In that way his hunting is justified; his efforts are noble. He is then a part of the environment and belongs, as other predators of the ocean belong. He becomes a part of the whole and that makes all the difference.

S

# What is Membership Camping?

A membership into a Camp Coast to Coast resort near your home allows you to enjoy weekends and special days. On longer vacations you have visiting privileges at over 375 outdoor recreation resorts in the United States, Canada, and Mexico.

You can enjoy the great outdoors—swimming, skiing, hiking, boating, fishing, hunting, horseback riding, tennis, golf, basketball, softball, horseshoes, shuffleboard, and other invigorating pursuits.

Or you can enjoy social recreation at family picnics, adult or teen parties, with supervised activities for kids.

Or you can just relax, soak up the sun, enjoy beautiful lodges with swimming pools, saunas, jacuzzis, and lounges or just wander through shady trails or lush meadows—all in tranquil settings.

You can enjoy all this activity, travel, or leisure amid the most spectacular scenery North America has to offer. A modest membership fee and it's all yours Coast to Coast.

Write us for information on a resort near your location:

Camp Coast to Coast  
Resort Information Exchange Service  
1000 16th Street, N.W.  
Suite 860  
Washington, D.C. 20036

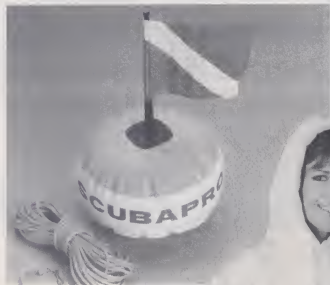
Make sure that your membership club is affiliated with  
**Camp Coast to Coast.**



Camp Coast to Coast  
Washington, D.C.



# SHOPPERS' CORNER



## NEW FASHIONS

SCUBAPRO is introducing all new diving fashions that are subtle and sophisticated. Made from the finest quality materials our new fashions identify you as a diver of discriminating taste. Perfect for all casual occasions as well as your diving ventures.

### SCUBAPRO HAT

Protects against sun and cold. Heavy duty — One size fits all!

### JERSEY

Heavy duty football style jersey identifies you as time-tested-tough. Gunmetal gray with white lettering, the jersey features half-sleeves and ribbed cross-over "V" neck. Look like a diving All-American! Available in sizes small, medium, large and extra large.

### "MUSCLE SHIRT"

New for the "in" diver. Muscle shirts are the latest rage in casual attire. White with subtle print in gunmetal gray. Ribbed armholes and neck with hemmed waist. Available in the following sizes: small, medium, large and extra large.

### GYM AND SWIM SHORTS

Perfect for all athletic endeavors and water wear, of course. Attractive topside, comfortable under your wet or dry suit. Navy blue, 100 percent Nylon Tricot with sewn in liner. Dries fast! Available in the following sizes: small, medium, large and extra large.

### SWEATSHIRT WITH HOOD

Stay warm, look great! White sweatshirt with silver/gray accent line at mid-chest. The hood is also lined with gray material that compliments the chest stripe. Made from 50 percent crelesand/50 percent cotton. Available in the following sizes: small, medium, large and extra large.

### WARM-UP PANTS

Warm, attractive, perfect after dive attire. Combined with the SCUBAPRO sweatshirt you will have a complete outfit. Gunmetal gray with waist drawstring and elastic ankle closures. Available in the following sizes: small, medium, large and extra large.



AVAILABLE



## DIVERS FLOAT

Signals boat traffic that there are divers down. Bright red and white inflatable ball with divers flag mounted on the top, sits high in the water for maximum visibility. Includes 75 feet of special floating PVC line and attachment clips.

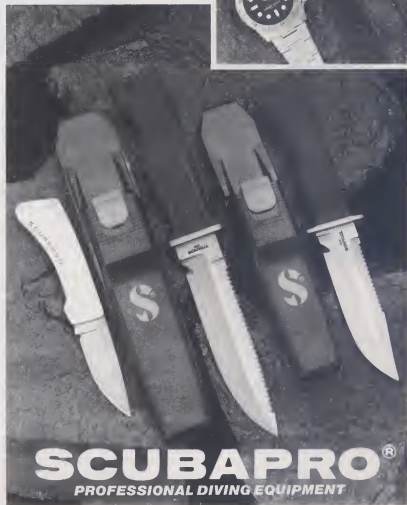
## TITANIUM KNIVES

Another breakthrough from SCUBAPRO. High tech Titanium blades make these the most exotic and practical knives in diving. Titanium is the perfect blade material — stronger and lighter than any other metal. Corrosion-free and anti-magnetic, they are the ultimate in knives.

The SCUBAPRO Titanium knives feature an amazingly fine cutting edge and a serrated opposing edge. In addition a special notch for line cutting is positioned near the hilt. Injection molded sheath includes a spring loaded locking device. SCUBAPRO Titanium knives are available in two sizes.

## FOLDING TITANIUM KNIFE

The ultimate cutting tool for the distinguished sportsperson. Compact and amazingly lightweight yet stronger than any other knife. Thin and compact when folded — only 3½ inches; opened it is 6¼ inches in length. Fits comfortably in pocket or anywhere. Non-corrosive and anti-magnetic. A perfect gift for anyone who enjoys the outdoors.



## TITANIUM WATCHES

High technology Titanium construction makes this the finest watch for diving and all outdoor activities. Elegant for dress wear, a certain conversation piece. So light you won't even know you are wearing it. Non-corrosive in a "brushed gray" distinctive design, combined with a special SCUBAPRO dial face. The ultimate in diving watches yet sophisticated in appearance.

SCUBAPRO Titanium watches feature:

- Luminous rotating bezel . . .
- Luminous hour and minute hands . . .
- Full sweep second hand . . .
- Anti-magnetic . . .
- Quartz movement . . .
- Silver oxide battery . . .
- Jeweled movement . . .
- Shock resistant . . .
- Strong band sheet glass crystals . . .
- Water resistant to 660 feet

AT YOUR SCUBAPRO DEALER

**SCUBAPRO®**  
PROFESSIONAL DIVING EQUIPMENT





Duncan Mathewson indicates area of Mullica River west of the dive site. Safety diver Randy Moore calls it a day



**O**n a warm day in mid-October, a group of divers looks out over the murky waters of southern New Jersey's Mullica river. A stone's skip away, the Garden State Parkway spans the river, carrying busloads of tourists south to Atlantic City.

More than two centuries-worth of water has flowed down the Mullica since a group of Colonial privateers lost their vessels to a vengeful British Navy. Today, under the guidance of professional ar-

# Mullica Stew

BY CATHIE CUSH

chaeologists, a group of volunteer sport divers will search the river to bring long-lost information about the battle to light. They're motivated not only by an interest in the past, but by a concern for the future of wreck diving.

The Mullica River project was part of a three-day field school co-sponsored by the Atlantic Alliance for Maritime Heritage Conservation and a local dive shop, in cooperation with the New Jersey State Museum. The field school followed an intensive two-day workshop in marine archaeological methods — one of many such workshops offered at various sites across the country by the Alliance since early 1985.

Based in Washington, D.C., the two-year-old Alliance is a non-profit educational group dedicated to promoting the rights of sport divers, marine archaeologists and shipwreck salvors. It was formed largely in response to proposed fed-

eral legislation designed to strengthen state and federal rights to historic shipwrecks. At the organization's helm are Executive Director Charles M. McKinney III, formerly of the U.S. Dept. of Interior's antiquities program, and Chairman R. Duncan Mathewson III, staff archaeologist for Treasure Salvors, Inc., the Key West, Fla., company responsible for the discovery and salvage of the Spanish treasure ships *Margarita* and *Nuestra Señora de Atocha*.

## A Nest of Rebel Pirates

Southern New Jersey today is dominated by resort towns along the coast and, on the mainland, a large wilderness area designated as the Pinelands National Reserve. Crumbling foundations scattered throughout the pine forest and a restored bog iron foundry and village at Batsto bear witness to the area's glory days in the 18th century. The Mullica River, which winds its way from well above Batsto

Cathie Cush is a free-lance writer based in Pennsylvania. She has contributed to many diving publications.

down to Great Bay, was a major thoroughfare and played an important role in the Revolutionary War.

A very successful group of American privateers worked out of Chestnut Neck, a small village on the Mullica near where the Parkway bridge crosses the river today. These watermen knew the back bays and channels so well they could slip out and capture large British merchant vessels and supply ships offshore without being captured by marauding warships. Records show as many as 452 privateers were commissioned during the war. According to the late South Jersey historian Henry Charlton Beck, sometimes as many as 30 armed sloops lay in wait for richly laden cargo ships bound for British-held New York. When the ships were taken, they were brought to Chestnut Neck or other towns upriver, where their cargo was unloaded and warehoused until it could be auctioned. The ships were either refitted, dismantled or burned.

In the summer of 1778 the "rebel band of pirates," as the privateers came to be called, captured the *Venus* and the *Major Pearson* off Sandy Hook, at the northern end of the Jersey coastline, and brought the vessels to Chestnut Neck. According to reports in local newspapers after the incident, the *Venus*, bound from London to New York, carried linens, satins, silks, shoes and medical supplies. The ship's remains were originally believed to be at one of the two sites on the Mullica investi-



Janet Fittipaldi shows students how to use surveyor's tools.

## Divers search the murky waters of a New Jersey river for Revolutionary War wrecks.

gated by the archaeological team.

As far as the British were concerned, enough was enough. A raid on Chestnut Neck was planned. Capt. Henry Collins led the fleet, consisting of his *Zebra* and two other sloops, two galleys and four other armed ships. The attack came on Oct. 6, 1778. The British troops, under the command of Capt. Patrick Ferguson, came ashore, stormed the earthen fort the Colonials had built and set fire to the town and the ships in the harbor. Reportedly eight sloops and schooners and a number of whale boats were lost. Most of the survivors resettled a nearby area now known as Port Republic. Shortly after, the flagship *Zebra* was deliberately scuttled when she ran aground on the shoals at the mouth of the river.

### Beachcombers and Ballast Stones

The divers arrive at the Chestnut Neck site 207 years and about two weeks later.

A stone column just off Route 9 commemorates the battle, and Cramer's Chestnut Neck Boatyard stands where the old harbor might have been. Our group of about 15 field school students are greeted by Mathewson and Janet Fittipaldi, and archaeologist representing the State of New Jersey. Also present are volunteers Pete Hess and Jack Fullmer, who have done preliminary work at the site; marine archaeologist Daniel Koski-Karell, who has brought a magnetometer to help locate other possible wreck sites, and safety divers and surface support crew from East Coast Diving Supply.

Fittipaldi, who is also volunteering her time, gives us some background on the site. Two wrecks were located decades ago. One, the Cramer site, is located just off the boatyard dock. The other, called the "bead wreck" because of some artifacts found three years ago, is on the other side of the river. Because the state

holds title to all tidally flowed lands, it alone has rights to the wrecks. New Jersey had granted us access in order to perform our survey.

We aren't the first to dive these wrecks — not even the first to survey them. About 10 years ago the state sent divers down. Some of the artifacts they retrieved were placed in the state museum; others were photographed and returned to the riverbed. Funding ran out before the project could be completed.

After a briefing, we're broken into three groups. The idea is to rotate chores, so that eventually everyone will have an opportunity to do everything that needs to be done. Lisa Morris, a PADI instructor from Ashland, Ky., and I are among those who are given land duty for the first shift. Fittipaldi shows us how to use a surveyor's transit theodolite and stadia rod to take bearings for future reference, then sends us off to the river's edge to collect artifacts. Before long, our hands are full of metal objects, bones and bits of ceramic.

"We'll feel really dumb if all this stuff is junk," I muse.

Morris agrees. "They'll probably just laugh at us."

As it turns out, that isn't the case. When we approach Mathewson with our "treasures," he's enthusiastic and supportive. A coin-sized piece of glazed pottery elicits, "That's good! That's good! That's definitely from the period." We place it in a plastic bag, which is dated and marked with the official site number. Then Mathewson

takes the piece of drainage conduit we have handed him and observes thoughtfully. "This is probably 20th century. I don't think we have to keep this."

Another student discovers a pile of stones that excites Mathewson. There are no other rocks in the vicinity, so the rounded stones are more than likely ballast from a ship's hold. Ballast can offer clues to a vessel's identity, itinerary and cargo. In fact, Mathewson has often said, "show me where the ballast is, and I'll show you where the treasure is." In this case there is no treasure, *per se*, but he says ballast did help direct the Treasure Salvors crew to the Atocha motherlode.

Our finds examined by Mathewson and Fittipaldi, it's time for a shift change. One team will pick up the land survey where we left off, while another will board a boat carrying a magnetometer and search the river. The magnetometer measures irregularities in the earth's magnetic field

# LCR<sup>TM</sup>

• LIQUID • CRYSTAL • RECORDER •

## Bridges the gap between flashers and charts.

- TOTALLY AUTOMATIC FOR SIMPLE OPERATION
- EASY-TO-USE COMPUTER-CONTROLLED FUNCTIONS
- ZOOM FOR DETAILED CLOSE-UP
- CLEAR, HIGH-RESOLUTION DISPLAY
- 4 DEPTH RANGES WITH AUTOMATIC DEPTH CONTROL
- SENSITIVITY CONTROLLED AUTOMATICALLY
- STOP ACTION
- FORWARD AND REVERSE
- EASY-TO-USE KEYS
- SWIVEL MOUNT FOR MULTI-ANGLE VIEWING

- SMALL AND COMPACT
- LIQUID CRYSTAL DISPLAY EASY TO READ IN BRIGHT SUNLIGHT
- DISPLAY LIGHT FOR NIGHT USE
- OPERATES AT HIGH SPEEDS
- WATERPROOF, RUGGED DESIGN
- STC REDUCES SURFACE CLUTTER
- NOISE REJECT SCREENS OUT NOISE AUTOMATICALLY
- LIFETIME-GUARANTEED SERVICE POLICY
- COMPLETE LINE OF 4 MODELS TO MEET NEEDS OF EVERY FISHERMAN

*THE ULTIMATE IN FISH-FINDING TECHNOLOGY...*

*PRICED LIKE A FLASHER!*

MADE IN EUFAULA, ALABAMA



**HUMMINBIRD**  
BY TECH-SONIC

ONE HUMMINBIRD LANE  
EUFAULA, ALABAMA 36027  
205-687-6613



caused by substances such as iron. The presence of iron could indicate another wreck. On the first day, several such irregularities are found. Over the next few days each is investigated by divers, but only one — which turns out to be an old anchor — is promising.

### Past History and Current Events

Meanwhile, it's our turn to explore the Cramer site. An advance team had buoyed the wreck sites. They also ran a line from the dock to the wreck and along one side of the sunken vessel. We make our first dive along this line. Our first goal is to orient ourselves and observe what we can. With less than three feet of visibility and a strong tidal current running, this could be a real challenge.

We push ourselves off the dock into about six feet of water, kick over to the piling where our line is tied off, then head down along the rope. For the most part, the wreck is only 10 feet deep, although the darkness of the river makes that hard to believe. We're there before we know it. Wooden ribs stick out of the river mud, covered with the growth of centuries. Much of the site is covered with oysters, and we must poke around without disturbing them or cutting ourselves.

The rope is tied off again and turns to the right at one end of the wreckage. A 30 to 40-foot section of the hull is exposed, but both ends are under mud. We're not sure at this point which is the bow end and which the stern. We swim against the current, dropping off the line occasionally to see what we can find below. Sometimes we grab ribs to keep the current from sweeping us out of sight of the wreck or each other. Then something breaks off in Lisa's hand. She taps my shoulder excitedly. She is holding a small stick, a few inches long and what appears to be the diameter of a silver dollar. We look at each other, puzzled. Its roundness leads us both to believe it is man-made, so we note our location, and she sticks the piece of wood in the pocket of her stab jacket. We're not looking to retrieve artifacts. After all, their location in relation to each other tells an archaeologist as much, if not more, than the artifacts themselves can. But since this one seems to have found us, we'll have it checked when we get back on land.

Midway down the hull there is a ledge, which drops off to about 30 feet. It's a mixed blessing. On one hand, if the muddy ledge is eroded by the tides and action from power boats on the busy river, the wreck could collapse and would be gone from us forever. On the other, by proving that the vessel is in danger, we may be able to get more time from the state to work on it. And, as Fittipaldi notes, the ledge affords us a cross-section of the hull that we might not otherwise get without excavating. We want to leave as much in



Artifacts recovered from the Mullica site in the mid 1970s. The numbers will be used to mark sections of the wreck.

place as possible.

We spend about 40 minutes combing over the wreck, swimming down to the end of the line, then drifting back with the current. We could spend much more time, but the day is drawing to an end, and we are all to meet for a debriefing before we leave the boatyard.

There's an excited buzz in the small room off the tackle shop where divers and archaeologists are gathered. It's been a good day for all involved, and the professionals tell us that we've accomplished more than we realize.

Professional Association of Diving Instructors Regional Training Director Jon Coon, of Brigantine, N.J., reports that he and his buddy spent their bottom time putting together a map of the wreck using their bodies to take rough measurements. They determined that the keelson, which runs above the keel to give the structure additional strength, is about 36 feet long. The ribs, Coon says, are about 8 inches by 6 inches, and there are 14 inches between them.

"That's important to know," Mathewson says. These are the kinds of clues they need to determine the type of vessel we are examining. "Now who can add some more information to the chart?"

"My partner found something," offers Gene Kadar, Brownsville, Pa. "We looked at it closer and it was copper sheeting." The sheeting is particularly significant. It was first used on British warships in 1761 and wasn't used on commercial vessels until 15 or 20 years later. This information will help the archaeologists determine the type of ship the wreck is and when it was built.

Morris shows her stick of wood, which

is immediately placed in a bag of water to prevent deterioration. When waterlogged wood is exposed to air it can split and crumble quickly. Mathewson tells us the piece is probably a trunnel, short for "tree nail." These wooden pegs were often used instead of iron nails. The type of wood it's made out of could determine whether the ship was built in Britain or America. Similarly, if we are able to retrieve any iron, its origin will tell us a lot about the ship's history.

During the next few days, more information is shared, more measurements made, maps sketched and a very few artifacts retrieved. A PVC grid, three meters square, is taken down so more accurate measuring and drawing can be done. Each new batch of data lets the archaeologists ask increasingly more specific questions. We aren't able to answer all of them in the short span of the field school, but the project has aroused enough enthusiasm that many of us who live nearby volunteer to continue to work on the wreck if the state will grant us permission.

In the meantime, the underwater archaeology project continues above water. The information we amateurs have gathered must be sorted, the artifacts and drawings analyzed. Eventually a report will be written and submitted to the State Museum. While the professionals do their detective work, we amateurs head back to our own jobs in the "real" world. But we take something with us. These nameless wrecks in a muddy South Jersey river have given us a chance to learn something, to share it, and to take history by the hand. And we're all the richer for it.

S

America's answer to the Koala  
is stirring up California waters.

# Sea Otters, Cute But...

**T**he late summer fog was beginning to dissipate in Monterey Harbor, signaling the sea lions and gulls to launch a verbal assault for the benefit of early arriving tourists. Our inflatable sent ripples across the otherwise glassy calm waters inside the Breakwater. Photographer, Don McMahon, gestured toward a raft of five or six otters floating in a small patch of kelp on the surface. "Mother and pup," he observed. "No chance of getting very close to them."

If we had jumped into the water the mother would have instantly grabbed the pup and paddled away from the danger. We killed the motor briefly and watched from a short distance as she meticulously groomed her young pup. A newborn pup is totally dependent upon its mother. The pup is so buoyant at birth it can only float on the surface like a cork, unable to dive until it is about two months old. The mother will groom and nurse the pup for five to eight months and is extremely protective of her charge.

We are here to get some underwater photos of the otters, which is often just an exercise in frustration. Sea otters, while somewhat approachable on the surface, usually retreat when divers get too close. To the untrained eye, floating otters look a lot like small logs with bumps at both ends, representing their head and webbed hind feet. They both eat and sleep in this position and rarely come ashore. Sea otters are much smaller than other mammals with whom they share the central California coast, such as the sea lion and the harbor seal. Generally, otters measure only four and one-half feet in length.

The males weigh close to 60 pounds, the females 40.

We drifted clear of the rafting otters and continued our search for a solitary animal, preferably one actively engaged in foraging for food. Because sea otters do not have an insulating layer of fat like other marine mammals, they depend upon a rapid metabolism and a layer of air bubbles trapped in their fur to keep them warm in water which averages between 50 and 56 degrees. To maintain this metabolic rate the otter must eat approximately 25 percent of its body weight every day. Its diet consists of over 40 kinds of invertebrates, including marine snails, starfish, sea urchins, clams, crabs, abalone and squid.

The third photographer of our group, Jim Stratton, was over the side of the boat almost before Don and I had spotted the bewhiskered face, munching contentedly on the tips of a starfish. I struggled to get into my mask and fins as Jim cautiously approached the otter, which seemed almost indifferent to his presence. With only a quick glance at Jim, the otter disappeared beneath the surface, returning only seconds later with another starfish.

We anchored the boat just inside the rock jetty as the Breakwater, about 20 yards from the feeding otter. Even with three of us in the water, it seemed perfectly content to continue its activities. Otters are opportunistic feeders eating whatever is available in a particular area. It is believed they favor sea urchins, abalones, crabs and clams, all of which provide a generous return in calorie intake when measured against the amount of effort it takes to collect them. When these invertebrates are in short supply otters will resort to taking snails, mussels, rock scallops, starfish and other less energy-efficient foods.

Otters have remarkable dexterity with their forepaws. They have learned to use rocks as tools, which help them break open shellfish and to loosen them from rocks. An otter will often bring a rock to the surface, float on its back and place the rock on its chest. Using the rock as an anvil, the otter will persistently whack the shellfish against the rock until the shell is cracked open. Otters also sport an impressive mouthful of teeth and strong jaws which enable them to literally crush hard shells. It is a good idea for divers to be very cautious about trying to pet otters which approach out of curiosity and even appear to be friendly.

Our subject seemed very willing to float around us at the surface, rolling now and then to wash shells from its chest and stomach. For over an hour it dove repeatedly coming back to the surface with small rock scallops and starfish. Authorities agree that most California sea otters feed three or more times each day, usually in the morning, late afternoon and at night. However, they may on occasion feed up to five times a day, with each feeding lasting over an hour.


After feeding, grooming has the second highest priority in the otter's day. Because its thick layer of fur is essential for retaining body heat, the otter must meticulously groom its air-filled fur before feeding and then again after for 25 minutes or more to clean the fur of food particles and refill it with air bubbles.

When our otter had finished eating he climbed onto a small area of kelp which floated at the surface and began working diligently on his fur. He seemed to enjoy frustrating our efforts to take pictures underwater by keeping most of his body above the water line. The grooming regimen complete, the otter's curiosity about our inflatable overcame him. Paddling with its webbed hind feet, the otter cruised over to our boat, and to our chagrin, taste tested the pointed ends of the pontoons. Apparently deciding they weren't good to eat, it hoisted itself up and over the side, and began rummaging through the contents of our boat. Finding nothing to eat, it slipped back over the side and paddled off. We breathed sighs of relief that the inflatable was still afloat. Many divers have returned to the surface after a dive only to find an inquisitive otter investigating the contents of their dive board or "hailed out" atop a dive mat left tied off to the kelp. While otters will often approach divers or let divers approach them, the choice is entirely theirs as in the water, they are sleek, fast swimmers who can disappear in the blink of an eye.

Steven Rosenberg is a professional underwater photographer and free-lance writer based in California. His work has appeared in many diving publications here and abroad.







# The weighty responsibility of owning a Shad Rap.

Last year, by conservative estimates, over 1.7 million fish were caught on Rapala Shad Raps. But the lure that's catching all the fish doesn't want to be the lure that kept them all. Please. Practice catch-and-release. And the makers of Rapala Shad Rap will make you very, very good at it.

©1985 Normark Corporation



## The Controversy

Even though the California sea otter is incredibly "cute," and often called the teddy bear of the ocean, there are a number of hotly contested issues which have evolved around the stability and vulnerability of the otter population in California and the otter's substantial appetite for shellfish.

Ironically, the same luxurious fur that protects the sea otter in the cold water of the Pacific almost led to its extinction at the hands of fur traders by the early twentieth century. In 1938, it was a newsworthy event when a raft of 50 or more otters were sighted off Point Sur in Central California. At that time, the estimated population of sea otters was 300. By the mid 1970's, their numbers had expanded slowly to approximately 1,500 animals along the Central California Coast.

In 1972, the Marine Mammal Protection Act was passed, transferring responsibility for the California sea otter from the State of California to the United States Fish and Wildlife Service. In 1977, the Fish and Wildlife Service designated the population of California sea otters as a "threatened species" because of its findings that the otter population was relatively small, restricted in distribution along the coast and vulnerable to the possibility of oil spills. This designation has drawn both support and opposition.

## Friends of the Sea Otter

"The Friends of the Sea Otter" is a group which supports a translocation plan to move a number of the otters to San Nicholas Island in Southern California to establish a second breeding colony. The group argues the sea otter is vulnerable to oil spills because it lacks a layer of blubber present in most marine mammals, and therefore must rely largely on its thick fur to keep it warm in ocean waters. Contact with oil mats the fur, and allows cold water to penetrate to the skin, presenting the possibility that the otter could chill and die within hours. Thus, they argue, should a major oil spill occur on the central coast of California there is a possibility the spill could contaminate a major part of the otter's habitat causing irreparable harm to the existing population. For that reason they want small numbers of otters — 30 to 50 each year for five years — translocated to establish a reserve breeding colony in an area within their former range. San Nicholas Island provides a good habitat and relative security from the threat of an oil spill. The group contends San Nicholas Island is a good site because of its isolation and purported insignificant importance to shellfisheries and recreational users.

## Save Our Shellfish

On the other side of the controversy, a group called "Save Our Shellfish" or SOS represents the Commercial Fisheries and



part of the recreational sport diving industry. They argue that California otters should not be on the threatened list because the California otters are the same species as the Alaskan otters which now number in excess of 160,000. They also feel that not only should there not be a translocation to San Nicholas Island, but that a reasonable management policy should be adopted which contains the otter population at its present location and limits that population to its current size.

This group believes that within the current range of the California sea otters, the population is at equilibrium or carrying capacity, with the birthrate at least equal to the death rate. "There is no scientific paper to support the contention that an oil spill would pose a threat to a significant section of the existing population of sea otters in California," states Bruce Steele, a representative of SOS. "Thus, there is no reason for a translocation." He adds that according to a study offered by the US Fish and Wildlife Service, an oil spill would present a substantially higher risk to any otters translocated to San Nicholas Island than to otters in their present location.

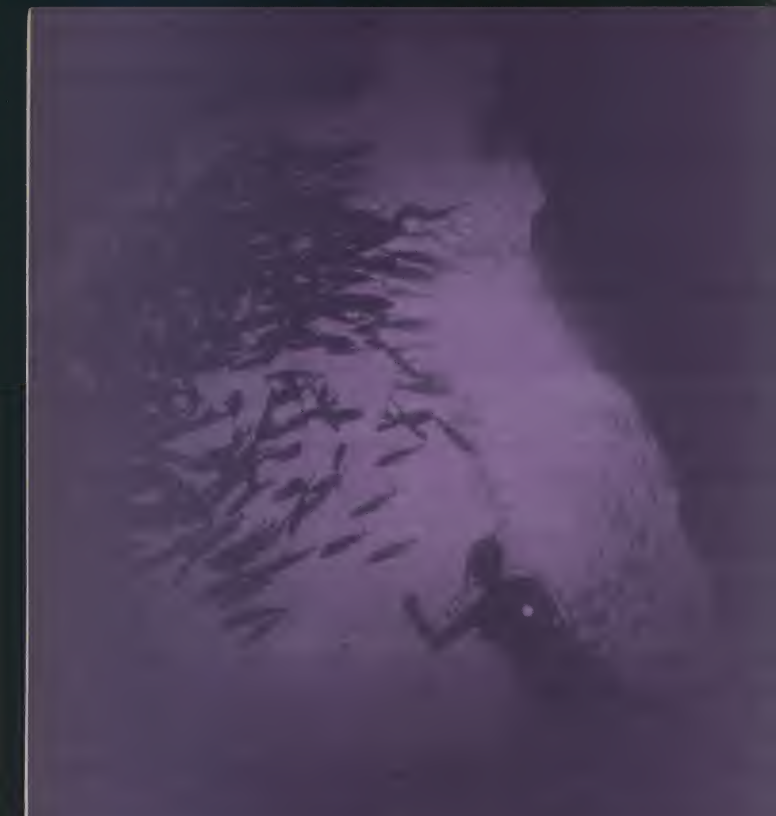
SOS strongly disputes the claim that translocated otters would be likely to remain at San Nicholas Island. They back up this argument with recent studies which made use of radio-collared otters. The results indicated that otter populations at carrying capacity have moved across wide stretches of open ocean to recolonize new, food-rich areas, and that even females with and without pups, crossed such areas. They also point out that there is no feasible nor practical known method of containment of an otter population which had reached carrying capacity, other than by birth control or removal of otters from that population. Further, even these methods wouldn't prevent a spread of the population to other islands.

SOS and recreational sport diving interests in Southern California point out that a translocation to San Nicholas Island, and thereby to other Channel Islands in Southern California, would be a disastrous blow, because the otters' appetites would soon indiscriminately wipe out the effective breeding populations of abalone, lobster and urchins, thereby economically ruining the shellfisheries in the Channel Islands and adversely affecting the extensive sport diving industry based there.

## Comments

There is no question that San Nicholas Island is not only a popular and heavily used destination for sport divers, but also an important area for shellfisheries. Given the information which is currently available from recent studies, it would seem the containment of a translocation of otters to San Nicholas Island is not realistic and that the spread of otters to other islands would be inevitable. It also seems equally clear that such a move would decimate the existing populations of abalone, lobster and urchins.

While the otter is a well-loved attraction on the California central coast, a translocation to San Nicholas Island or anywhere else along the California Coast which experiences heavy sport diving usage connected with shellfish, would seem to be an ill-conceived plan at best by the diving community. Most California divers seem to welcome the protections currently extended the California sea otter population. However, that same diving community would probably extend those same protections to the populations of urchins, abalone and other invertebrates which now prosper under the management policies of the state. The protection of the one species should not be over-emphasized to the detriment of the rest, potentially endangering the fragile balance of the marine environment. **S**



# **VIVA the New G250!**

BY LOU FEAD



## SCUBAPRO'S new regulator offers complete breathing comfort and rugged durability.

**I**f a second stage delivers breathable air, I'm happy with it." The same reasoning applies to automobiles until you've driven a Rolls. One gets the job done, the other elevates the mundane to the sublime.

The ultimate regulator would duplicate the ease of breathing you're enjoying as you read this. That is not possible underwater as air in a tank is under considerable pressure. If it were not regulated, you'd be a float in Macy's parade. But the goal of regulator design engineers is to come as close to the impossible as possible.

Remarkable progress has been made, although some of us will never forgive them for engineering double-hose rigs into extinction. Like fins on a Cadillac, they just never looked the same without 'em. So we got the single hose and forever after looked like patients hooked to a life support system — but that's progress.

Over the years we've seen many improvements: the downstream regulator in 1963, the adjustable downstream in 1969, left hand adjustable octopus in 1975, the pilot regulator in 1977, the A.I.R. I and II in 1979, the Mark X in 1984, and the Balanced Adjustable in 1985. Each was an improvement in ease of breathing and diving safety.

Starting with a commitment to use high strength, rugged fiberglass reinforced polyesters to both protect internal parts and allow for design flexibility, a new regulator, the G-250, has been built around the heart of the Balanced Adjustable Mark X to be not just the next generation of regulators, but a whole new concept in

adjustable second stages.

The key features of the new G-250 are the two external controls which permit a diver to regulate both initial inhalation resistance and aspirated flow while "in the water."

The G-250 also has a 40 percent larger silicone exhaust tee which greatly reduces exhalation effort. The exhaust tee is molded as part of the case to eliminate the possibility of accidental loss during a dive.

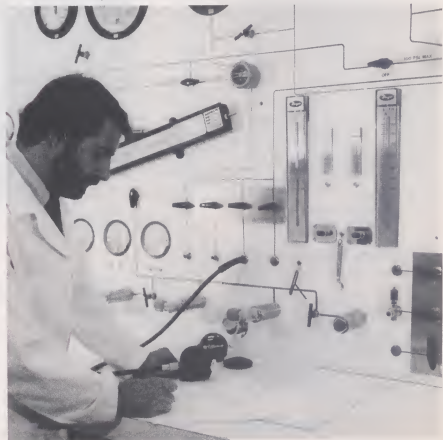
The use of rugged fiberglass reinforced polyesters in the case protects the G-250 from even the heaviest abuse. The material will not corrode even when exposed to constant saltwater use. The G-250 also incorporates all of the high

tech features which are standard in all Scubapro second stages including an orthodontically contoured mouthpiece, the use of silicone in the diaphragm and exhaust tee where a highly sensitive material is essential for providing both ease of operation and superior strength, and Scubapro's limited one-owner lifetime warranty.

The G-250 has two major components: the injection-molded, high-strength case and the brass and steel demand valve.

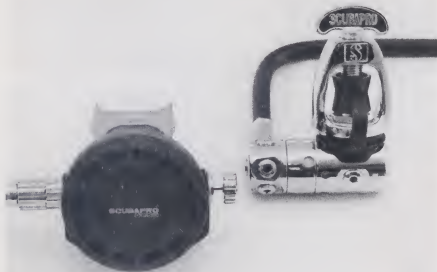
The two components are easily disassembled for field cleaning and repair and the components can be replaced separately if necessary. The case contains the mouthpiece, inhalation diaphragm, aspiration flow vane and exhaust valve. Virtually

The new G250 was subjected to extensive testing at every level of development



Lou Fead is the author of the popular book "Easy Diver," and is a free-lance writer based in Miami, Florida.





indestructible when compared to a chrome-plated brass case, it also includes the exhaust tee as an integral part.

The heart of the G-250 incorporates a totally "air balanced poppet." Pneumatic balancing is accomplished by allowing the incoming air to push equally on both ends of the poppet, thus canceling the downstream effect. In the G-250, a small hole is drilled through the poppet and stem, allowing the air to flow to a small, closed chamber on the opposite end of the poppet. This trapped air pushes the poppet back toward the downstream force and cancels its effect. A lighter spring can now be engineered for overall response smoothness and minimum breathing effort.

#### Inhalation Resistance Control

The Scubapro G-250 enables the diver to precisely set the inhalation resistance of his regulator underwater. This is accomplished by housing the valve compo-

nents in a tubular air barrel that extends through the center of the second stage case. A splined knob is located on the left side to allow spring tension control from the outside of the regulator. By turning the knob, spring tension can be increased or decreased allowing the range of breathing resistance to be tuned to the exact needs of the diver.

Normally, the amount of inhalation resistance would be adjusted for the minimum breathing exertion, but during special circumstances the regulator can be adjusted for harder breathing. For example, if the diver is working in a head down position, the G-250 can be adjusted to prevent the uncomfortable feeling of overfilling his lungs. When diving through surf or heavy currents, the ability to temporarily stiffen the regulator helps to eliminate "air surge" resulting from water deflecting the diaphragm. The G-250 second stage can also be used effectively as an

octopus or backup regulator. By adjusting the regulator for maximum resistance, the accidental loss of air can be greatly reduced. If the backup regulator is needed, it can be quickly readjusted to minimum inhalation resistance.

#### Diver Controlled V.I.V.A.

The G-250 is also easier to breathe because of V.I.V.A. (venturi initiated vacuum assist). V.I.V.A. comes from the aspirator flow vane located immediately in front of the mouthpiece. This vane is controlled by a small knob on the outside of the regulator. By adjusting this knob, the aspirated flow of the G-250 can be totally controlled by the diver. The flow vane is positioned directly in the path of the aspirated air and is designed to deflect the air stream, changing its intensity. In the minimum position, the vane allows normal air flow to the mouthpiece for regular breathing. In the maximum position, the flow vane permits the air stream to blow directly out of the mouthpiece generating a maximum venturi effect. This high velocity air pulls the still air inside the regulator along with it, causing a secondary pressure drop or vacuum to exist inside the case. This vacuum draws the diaphragm inward, depressing the lever and opening the valve. The G-250's low inhalation resistance is thereby supplemented by a reduced continued effort to make the regulator virtually breathe by itself. Combined with the "inhalations resistance control" feature, virtually any level of breathing comfort can be achieved.

The combination of effort reductions brings the G-250 close to the ideal — that of no inhalation or exhalation effort whatsoever. Viva for V.I.V.A. because it essentially creates a regulator to last a lifetime of diving that is both an easy breather for the novice diver during initial training and early competence-building excursions, plus an extra-easy breather for the experienced diver who's sufficiently proficient to calmly manage any free-flow that may come from tuning the G-250 to the edge of no effort.

Besides making the G-250 a better breathing machine, the engineers designed in a bit of fashion. They cast the diaphragm in orange to shine a splash of brightness through the new diaphragm cover.

The engineers didn't, however, change the time-tested and proven characteristics of the brass/steel demand valve of the familiar Scubapro adjustable second stage. They left it like it was inside, but made some changes on the outside so it could snap and seal into the new plastic case quickly.

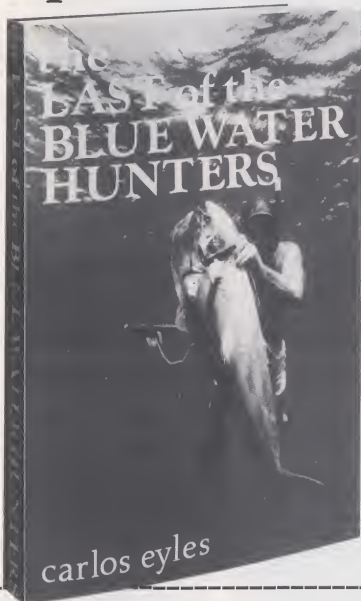
The G-250 is a new second stage that's doubly adjustable, easily breathable, and readily maintainable. Its features and benefits make it the ideal second stage for adding breathing control to anyone's diving.

Illustration by Nick Fain



This bag has the abalone and lobster tails, I got plenty of scallops, but the spinach just didn't look fresh.

# The true story about the legendary blue water spearfishermen, the greatest



*The Last of the Blue Water Hunters* has it all for the spearfishing enthusiast.

**Adventure** The story begins with Carlos' return to Catalina Island, where for four months he lives off the sea using only a speargun to sustain himself. It ends with the best divers in the world stalking 400-lb bluefin tuna in the deep Pacific. In between are 50 years of spearfishing adventure, including everything from shark attacks to giant fish towing divers miles out to sea.

The author of *Diving Free* and *Sea Stalking* reveals the spearfishing techniques used by the masters of the sport.

**History** Meet the men who started the diving revolution — Florida's Art Pinder who landed a 100-lb sailfish in 1948 using a simple Hawaiian sling; the Pacific pioneers who first trekked into those waters and discovered 25-lb lobsters walking around in six feet of water.

**Photography** Rare and exciting topside and underwater photographs dating back 40 years.

*"The exploits of these fearless and remarkable men go beyond your wildest imaginings. One of the great books on diving."*

*Richard J. Smith*

President of SCUBAPRO

## Creative Endeavor Publishing

701 S. 1st Ave / suite 430 Arcadia, Ca 91006

Send me \_\_\_\_\_ copies of the *Last of the Blue Water Hunters* at \$9.95 ea.  
Add \$2.00 for postage and handling.

Name \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

## divers ever to put on a mask and a pair of fins.

Allow 4 weeks for delivery

# Celebrity Seafood Sampler

BY MAVIS HILL

**T**here is no shortage of hearty, delectable and nourishing seafood in the homes of our three recipe contributors. These men virtually live in and for the sea seeking knowledge, sustenance, income and the sheer joy of it. Peter Fields, Glen Egstrom, and Carlos Eyles are all involved to one degree or another in harvesting the benefits the sea offers.



**Peter Fields**

Writer and wreck diver extraordinaire, Peter Fields profits from his diving expertise partly through "Fields Henry Pty. Ltd.," a deep diving equipment specialist business which he owns in Coogee NSW, Australia. He is also a top underwater photographer and author and spends much of his time deep below the surface exploring historic shipwrecks.

In July of 1985, Fields dove the newly discovered wool clipper barque, the *Centurian*, the fastest clipper of the Aberdeen White Star line which now rests 60 feet below the surface of Sydney Harbor. She sank 98 years ago. The *Centurian*, a wonderful new dive site lies in sheltered, sometimes remarkably clear, warm water

and is a great pile of concreted chain, iron ribs, and deck beams. This was a composite ship, built of timber on iron frames with copper sheathing for speed and torpedo worm protection. Fields finds the *Centurian* a great site for teaching the basics of wreck diving; her bones will give divers much pleasure for many years to come.

Peter continually lauds the great diving at Sydney and vicinity where there is a plethora of shipwrecks. "A haven for fish and a heaven for wreck divers," he states, "where sturdy little ships plied between Sydney, Newcastle, and Wollongong during the early 1800's." Twenty of these wrecks have so far been discovered, and one is thought to be the victim of a wartime German mine.

Raised in New Zealand and active in the diving industry there, Fields was at one time a partner in the largest retail and commercial diving company in that country. Later, in 1977, he sailed a yacht with two friends from Auckland to South America via Cape Horn and dove the Cape, which he says was "cold and miserable." On that trip they also explored Tierra del Fuego and the extreme south of Chile for historical wrecks. Fields and his buddies also did some diving at Robinson Crusoe Island off Valparaiso, where they found superb underwater conditions as well as at Easter Island in the mid-Pacific.

For a little over a year, Peter Fields has been actively involved in a project photographing some of the many shipwrecks on the New South Wales coast around Sydney. The results will ultimately yield a computerized audio-visual presentation showing the ships as they once were and as they are now.

Peter loves all seafood. "Anything goes, and usually well and rapidly!" he exclaims. And he lends what he calls his "meagre reputation" to the following recipe, a succulent, warm and hearty meal in one dish:

## Scallop Spinach Pie

**Pastry for 1 crust pie**

**1 pound spinach, cooked and chopped (or frozen, thawed)**

**4 eggs**

**1 cup dairy cream**

**½ cup scallops, cut into ½-inch pieces**

Bake the pie shell for five minutes in preheated 450° oven.

Spread the spinach on the bottom of the pie shell. Beat eggs, add cream, and beat some more. Add seasoning and scallops. Pour scallop mixture over spinach, reduce heat to 350° and place the pie in the oven. Bake for 15 to 25 minutes or until a knife inserted comes out clean. Serves four.



Free-lance writer Mavis Hill specializes in diving, seafoods and sea life. She has authored over 200 articles on edible sea life, plus a book, "The Edible Sea."



## Dr. Glen Egstrom

One would be hard pressed to find a diver who hasn't met Glen Egstrom, or at least heard one of his lectures which he gives frequently throughout the United States and other countries. If you're one who hasn't met him, the next time you're at any kind of a diver education or research seminar — specifically one of the annual International Conferences of Underwater Education (ICUE) — look around for a tall, robust frame under a friendly, handsome face. If the face is topped with a short crop of blond hair, you've found Glen.

Glen has been active or somehow involved with just about every meaningful project in the underwater world so far. It was for his efforts and devotion to these interests that he was the winner of the 1969 NOGI Award, administration section, which is given for distinguished service each year. Having been associated with the University of California at Los Angeles for many years, Egstrom involves himself in education and research relating almost entirely to diver safety projects.

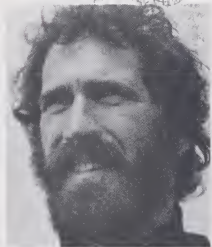
He is currently researching diver mobility in wetsuits; a study of the drag characteristics of divers in various equipment configurations and fluid balance in divers. Also, the Diving Safety Research Project is continuing with regular evaluations and emergency procedure standardization.

Glen Egstrom will eat anything from the sea, his favorites being fried halibut, barbecued albacore, fried abalone and squid, plus ginger fried fish. He suggests the fried abalone recipe from our book, *"The Edible Sea,"* and given below:

## Fried Abalone

Remove abalone "foot" from the shell, discarding the soft viscera between the shell and the foot. Remove the flange from around the

edge of the foot (meat) with a sharp knife, then slice the meat horizontally into 1/4-inch thick slices. Pound each slice with an "ab" hammer or tenderizer very lightly, but thoroughly to tenderize. Resulting steaks should resemble satiny, limp pancakes. Dip each steak in egg beaten with water or teriyake sauce, then coat with cracker crumbs, or even better, "Dixie-fry" (for a "Down South" flavor). Fry steaks very quickly in a half-and-half mixture of very hot butter and oil. Fry no longer than 30 seconds per side. If tenderized properly, a tender abalone species cooked in this manner will give you a steak you can easily cut with a fork.



## Carlos Eyles

One of Carlos' friends described his life well when he said, "Carlos virtually lives the life of an underwater Indian." Eyles' lives the simple life on his boat, writing in the fall, winter and spring. Each summer Carlos heads for Catalina Island off the California coast, where he anchors up and lives off the sea, writing and shooting

underwater photos that accompany the many articles he writes for various magazines. Divers and others who have enjoyed the first four Eyles' sea novels published to date, can look forward to his fifth, now in the works. *"The Last of The Blue Water Hunters,"* published just last fall, is fascinating non-fiction which covers the last 50 years of big game spearfishing in America. The history is interwoven with a personal journal of a four-month period Carlos spent living off the sea, using only a spear gun to sustain himself.

It goes without saying that Carlos Eyles enjoys all kinds of seafood cooked in a variety of ways. However, he states, "Lobster holds a sensual curse over me of which I have been unable to shake, and

remains my favorite seafood." Since his lifestyle requires an eye to economy, instead of using commercial fuel to boil a lobster, Carlos uses the following method for his favorite lobster recipe:

## Lobster Tails Eyles

Build a hot fire. Split lobster tails in half, lengthwise, and remove the vein. Over the hot fire, melt enough butter in a frying pan to cover the bottom of the pan. Cut up several cloves of garlic into thin cross sections and saute in the melting butter. Add several tablespoons of lemon juice (less, if pan isn't chock-full of lobster tails) and a splash of white wine to taste.

When pan is good and hot, place the tails shell side down for several minutes, then turn and cook the meat side until it is browned. Remove tails.

Add another quarter pound of butter, or less, mix in more lemon juice and wine. Scrape the pan of its residue of cooked lobster and garlic, mix well and use this sauce as a dip for the lobster.

# Islands Lost to Time

Little changed since Darwin's visit, the Galapagos offers divers as much to see onshore as off.

BY M. TIMOTHY O'KEEFE

**N**ormally it's impossible to dive one day with penguins, sea lions and fur seals and the next with warm-water reef fish and marine turtles. These creatures are usually found thousands of miles and thousands of dollars apart . . . except in the fabled Galapagos Islands.

Serious underwater photographers will expose a lot of film taking advantage of this unequalled opportunity. And they'll be just as busy ashore. The land animals are perhaps even more fascinating; in fact, one-third of them exist nowhere else on earth.

The Galapagos Islands, where Charles Darwin formulated one of the greatest scientific theories of all time, are even today a mysterious land seldom visited by North Americans.

Located on the equator between 500 and 700 miles off the coast of Ecuador, the first Spanish explorers named them the "Mysterious Isles," and they are indeed that. Many of the land animals such as the three-foot long, dinosaur-like iguanas and huge land tortoises, were so isolated from the South American mainland that they evolved in ways distinctly apart from their nearby cousins.

The marine creatures, however, are the same as found near the South American continent and include: crabs, spiny lobsters, sea urchins, starfish, turtles, skates, sea lions, penguins, manta rays, whale sharks, porpoises, sperm and killer whales as well as numerous varieties of reef fish.

What accounts for such a diversity of marine creatures are the two Pacific

ocean currents that cut through the archipelago which is made up of 14 main islands and many smaller ones. The colder, dominating Humboldt current (as low as 63 degrees Fahrenheit) streams up from the Antarctica, while the warmer El Nino current (as high as 86 degrees) originates off the coast of South America. Not only do the two combine to create the ideal environment for such an unusual animal mix, they also prevent the Galapagos Islands from being extremely hot and dry despite their Equatorial location.

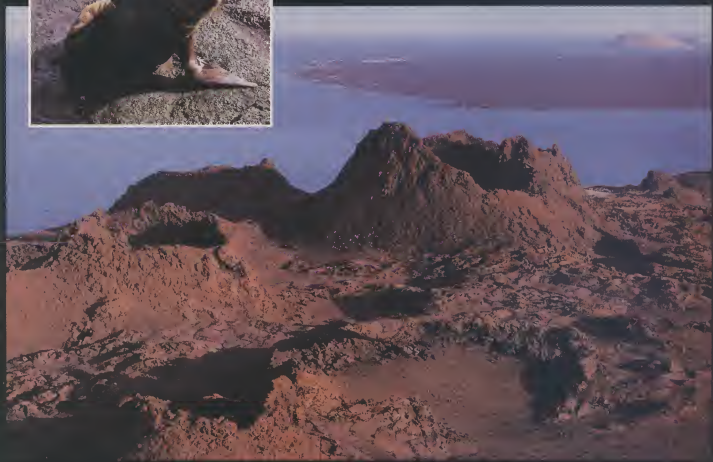
The cold Humboldt stream acts as a cooling element and also helps create the annual rainy season from December to May. The rains, however, are brief and the sun shines most of the time. During the remainder of the year the skies are usually overcast until midmorning, sometimes all day, under the influence of what is called the "garua." The sun actually shines more during the rainy season, but this is of little consequence in this strange land overlooked by time.

Darwin, with his theory of evolution, immortalized the Galapagos following his visit in 1835. To fully appreciate the rarity and exceptional nature of the Galapagos, it is first necessary to understand how Darwin developed his theory. In Darwin's time, it was accepted scientific fact that an animal species was something fixed and unalterable. But Darwin found on these few isolated volcanic mounds an astounding number of species that not only differed from those on the mainland, they differed remarkably from island to island. Each island, in fact, had its own peculiar tortoises, plants and birds.

Darwin concluded that animals were brought to the islands from South America by the winds, on driftwood or other

M. Timothy O'Keefe is Editor At Large for Florida Sportsman and a frequent contributor to major outdoor publications. His photo credits include Time-Life books and National Geographic.





Galapagos frigatebird



Iguana

means and adapted over a long period of time to the special conditions on each island, and so evolved into new species. The most striking example of this adaptation was found in the 13 different species of finches which varied from island to island. All the finches have a beak of a peculiar form and use it in a special manner for getting food. One kind of finch pecks on trees, as woodpeckers do, while another has developed the beak of a parrot.

Evolution was the answer to why the Galapagos became home to so many one-of-a-kind animals. Consequently, anyone visiting the Galapagos automatically becomes a naturalist of sorts. It is difficult to travel from island to island without getting caught up in how the animals manage to survive on such barren, inhospitable lands, some of which are composed of nothing but volcanic ash. More striking than the uniqueness of the animals is their lack of fear of one another, and especially their fearlessness of man.

This overwhelming sense of compatibility and harmony has a profound, almost religious effect on new visitors. Nowhere else on earth is it possible to walk amidst nesting birds, legions of iguanas and huge herds of sea lions and fur seals and not have the animals flee almost at the first sight of you. The Galapagos are no lush Garden of Eden, but similarities exist.

Since predators are few on the islands, the animals have lost their wariness of virtually all other creatures, including man. Amazingly, even underwater, the sea lions and fish act the same way despite the presence of quite a few predators, including hammerhead sharks.

Because the waters are so plankton

rich, visibility is somewhat disappointing, usually between 60 and 80 feet. But with so much activity so close-up — the sea lions gladly play tag with you — much more isn't needed.

Only one island, Santa Cruz, has a hotel with its own dive operation. The Galapagos Hotel, which has just started offering diving. It uses a 22-foot open boat with a capacity of six divers to visit the various sites around Santa Cruz. Situated on the water at Academy Bay, the hotel rate for room, meals and diving is less than \$70 per day. For information, write Hotel Galapagos, Isla Santa Cruz, Galapagos Islands, Ecuador. Reservations can be made directly by mail or through an Equadorian travel agent.

The sailing vessels anchor several hundred yards offshore and get to the dive sites or landings in rubber inflatables called "pangas."

Divers interested in live-aboard trips can save quite a bit of money (enough to cover your airfare from the U.S.) because of an interesting situation that exists here. Regardless of who you book through, everyone ends up on the 70-foot motor-sailer "Encantada." The boat is jointly owned by Metropolitan Tours of Ecuador and the Ecuadorian government who have contracted with two American tour operators exclusively. However, the boat is also available for charter directly from Metropolitan through its U.S. agent. Depending on how you travel, the price difference can be substantial.

San Francisco based See & Sea, for example, currently charges \$2,900 per person for a 18-day trip that includes a two-week cruise, dive escort and three nights with meals at the Hotel Colon in Quito, Ecuador. Round-trip airfare from

the U.S. to Quito and from Quito to the Galapagos are extra. La Mer, in New York, charges \$2,800 for an almost identical trip (including escort) that is 17 days, one day shorter.

A significant savings can be realized by chartering the 10-passenger "Encantada" yourself at \$7,500 per week plus \$125 per week per diver. It's possible to duplicate the See & Sea and La Mer packages for about \$2,000 per person, including overnights and meals at the Hotel Colon in Quito. That's a savings of \$800 to \$900 for each diver, which would just about cover round-trip airfare from Miami-Quito-Galapagos. You would need to fill the boat with 10 people in order to get the greatest discount.

The tour operators charging more because they will sail with as few as five passengers. Their higher price ensures the "Encantada" will sail on the dates each company has scheduled for its clients.

The "Encantada" has a cruising speed of six knots and accommodates its 10 passengers in five double cabins with upper and lower bunks, two toilets and wash basins, and a single shower. It has a large salon midship and a good amount of deck space. It has additional quarters for a crew of four and one naturalist. Every boat must have its own naturalist since the Galapagos are now a National Park. The naturalist not only serves as a guide but also makes sure visitors do not disrupt the animals.

A newer boat, "Amigo I," began regular dive service this past February. Sixty-two feet long and a cruising speed of 9 knots, it accommodates 14 passengers in seven twin cabins. It charters for \$9,900 per week, with an extra charge of \$125 per

(Please turn to page 75)

Diving from pangas beneath Pinnacle Rock on Bartolome Island.





# Flirting With

BY FRANCIS LeGUEN

**B**elow me, the huge indigo blue mouth of the cave awaits. I try not to think of the hundreds of alligators, which sunbathe on the banks of the lake around me. Too late to return, the only solution is to dive.

I breathe a string of silvery bubbles and start to sink into the crystal clear, 77-degree water.

We are in Florida, but not in an exhibit at Disney World and the breathing gear I am wearing is not like that on display at Cape Canaveral. No, I have just submerged into Christmas Spring, a flooded cave which gives birth to a small stream. I am diving in search of mammoths which disappeared 12,000 years ago.

After a nearly 40-meter vertical dive, I land on a turquoise blue sand dune



which slopes at 45 degrees. Sun beams still dance on the sand, but two meters lower within the cave there is everlasting night. Once inside the cave I have to switch on my lights, and my bubbles remain imprisoned under the overhangs.

I am floating in an immense black gallery, at the bottom of which the stream spurts. To penetrate the flooded gallery, I must snake through a restricted passageway. The water flows at 38 cubic meters per second and offers the resistance of a real water wall. The aquatic tornado toss-

Divers must share Wakulla Spring with resident alligators. Diver, at left, examines giant mastodon bones at Hornsby Sink. At right are entrances to the deep galleries at Wakulla.

es me about over and over but by using my hands and feet, I pass through the restriction and propel myself into a quieter area. Out of breath, I stop to rest.

My sight field begins to narrow, my joints crack unpleasantly at the slightest gesture. I feel as if my blood is sparkling, and I breathe with more and more difficulty, as if I was inhaling molasses. I have just entered the narcosis field, the pointer of the depth gauge is fixed on 60 meters.

Floating in perfect buoyancy, I go down under the vaults of a vast rectangular and horizontal gallery. I force myself not to think about the 70 meters of water and rock above my head. My lights make bright circles on the floor, 10 meters beneath me. The limestone walls are corroded. From time to time, I hook the guideline I unroll to find my way back to the ledge. I am caught up in a slight euphoria. I can't feel the warnings of my body any longer. Only the long experience I have with

Francis LeGuén, 27, the youngest member of the French Explorers' Club, is a photographer for the SYGMA press agency and a free-lance writer.



# th Folly

French team dives seldom visited caves to film documentary.



Above is a mastodon reconstructed from bones found in Wakulla Springs. The animal would have weighed 10 tons.

deep dives enables me to make a dive to this depth.

I go forward slowly. From time to time, I exhale deeply several times to eliminate the carbon dioxide which builds up in the lungs and poisons the blood. I repeatedly check the phosphorescent pointers on my watch and the depth and the pressure gauges.

## Monsters In The Night

Suddenly in front of me, the deep blue night is broken by hundreds of orange points — eyes — coming to meet me. Hallucinations? They come closer. I can then discern below the eyes, the huge mauls of giant catfish, as black as ink. The fish are lured by the lights and spring from everywhere, bang into me, and knock on the glass of my mask. They spin round, showing their corpse white bellies.

Further on, large eels seem to sprout from the walls. They approach with their





A full wetsuit is not necessary in Florida's warm-water springs.

snake-like swim and reel around my neck and hoses. On the way back, I find two of them clinging to the guideline! I wonder how these animals feed and find their way in the perpetual night of the cave.

The ceiling that I am using as a guide suddenly disappears. I check the small pointer of the depth gauge and the arrow of the compasses once again. I soon reach a rockpile and land on the summit, taking heed not to stir up the sediments which would muddy the water.

While resting I look upward and notice the blackness is dotted with bright points. A starlight sky? In fact it is only transparent crayfish floating with all their feelers out like satellites. Ending my rest, I dive into the unknown. The ceiling reappears at 75 meters. A mark on the guideline indicates

I am 300 meters into this stream. It is time to return. I hook the line and start back.

I spot what I first believed was an odd shaped rock. Looking closer, I recognize a giant shoulder blade. Beside it, a femur lays looking like a dumbbell. A little farther, I notice a line of cervical vertebrae which could be used as frying pans. Half buried in the sediment, a splendid ivory tusk appears. I realize all these heaps of black stones are bones, literally a pyramid of mastodon skeletons. It is a fantastic sunken cemetery of priceless archaeological value.

#### Diving In 12,000 Years Of History

Hidden in the tall ferns, an enormous tiger with sabre-shaped teeth is on the lookout. Unconcerned, a camel, taller than a giraffe is browsing the tops of the

Diver examines mastodon jaw

cypress. Around a poor fire, a few men who have learned to make weapons from a bone or flint, eat the scraps of a giant turtle.

Suddenly, the smelly earth resounds. Moving mountains appear. A herd of mastodons goes to the water to drink. The largest weigh 15 tons and display superb, curved, three meter tusks. The fog has spread over the swamps and the big males hesitate. A yearling which has moved away from the group, feels the ground suddenly slip away beneath him. He falls. His mother comes to help and falls in her turn. In a maddened trumpetings concert, the animals splash about in the water but, too heavy to swim, they drown. Their huge bodies sink straight down into the depths of the spring for a very long sleep.

Some 12,000 years later, a sci-fi creature shakes my arm. Cheryl has just discovered a fossil buried in the sand. It is a magnificent jaw with two molars — those of a mastodon baby . . .

For one month, we have been diving in several Florida caves, taking photographs of the fossil museums buried in the water. And for one month, it has been an ordeal. At a depth of 70 meters, thoughts are misty, gestures are inaccurate. The slightest adjustment, the slightest focus requires great effort.

Cheryl shows me her pressure gauge and raises her thumb upwards. I make a circle with my thumb and my forefinger to tell her I have understood and we start up to the surface. At 50 meters the daylight appears, enabling us to appreciate the fearsome size of the cave. Veronique, who stayed on the surface looks like a tiny glow worm in the distance.

We are still separated from the surface by a one and a half hour decompression stop. Curious fauna join us for the wait: schools of grey mullets, soft water groupers, turtles and gars which are a kind of huge pike with threatening teeth, but which, fortunately, only snap at insects on the surface.

Veronique joins us and brings a spear-point she found in the sand. Her discovery links us to another time in the past.

Seminole and Creek Indian lived in Florida long before the arrival of the white man. One of the most famous springs, Wakulla Springs, is also called by a name derived from an Indian word which can be translated: "where the water flows upward like the rays of heavenly light out of the shadow of the hill." That may be a perfect definition of a deep karstic spring. Thus, in the far off past, these caves which spew thousands of gallons of water already fascinated men. Wakulla Springs is

(Please turn to page 51)

Schools of curious fish frequent the tepid waters of Ginne Springs Pool.







A music volute mollusk showing note pattern of shell. Inset photo is a flamingo tongue mollusk

BY DEE SCARR

How to collect unusual shells on film.

# She Shoots Sea Shells



Giant clam displays a large area of mantle

**S**hell collecting can be a terrific hobby for divers — if it's done with a camera. There are two major advantages to this unusual "collecting" method: first, the animal is not killed and can thus be collected by an infinite number of people. And second, the photographic collector captures not only the shell, but also the living animal within. Frequently the animal that constructed the shell is fully as beautiful as its house.

A classic example of the animal-in-shell versus the shell-only philosophy is the common flamingo tongue (*Cyphoma gibbosum*). Alive and undisturbed, this creature is a creamy yellow in color with irregular dark yellow spots outlined in black. Collected and killed, the flamingo tongue shell becomes an undistinguished pale orange and white. Why? Because the pretty little spots are part of the living animal, its mantle; when the animal is removed from the shell, the mantle goes too.

Another example of a lovely animal within a shell is the music volute (*Voluta musica*). It was named (by traditional collectors) for the pattern on the shell itself, which looks like musical notes. The volute has a long history. It has been depicted in books and paintings as far back as the seventeenth century, and, in 1758, became one of the first shells to be classified by Linnaeus. In the next hundred years, the music volute was given 24 additional Latin names by entranced collectors, including *Voluta confusa*!

Operator of "Touch the Sea," a personalized dive guiding service based on Bonare, Dee Scarr is a free-lance writer and author of "Touch the Sea," and a new Avon book, "Coral's Reef."

These early admirers of the music volute were unlikely to have had the opportunity available to us of observing this mollusk alive in its own environment. The animal spends the bright daylight hours under coral rubble or buried in the sand, in relatively shallow waters of 10 to 30 feet. At twilight, it forages openly for food and is more likely to be found.

When first disturbed, the animal instinctively withdraws into its protective shell, but after a few minutes, it's eager to get back to business and begins to emerge. The observer's patience is well rewarded by a glimpse of the mollusk's body, decorated as it is with the same pattern as the shell. When the creature is fully extended, I often wonder how so much body can fit into so small a shell!

Like most mollusks, the music volute will move about actively once it realizes there is no danger. This is the time for photography. Place the animal on an interesting background and photograph both animal and shell. When I finished photographing the music volute whose picture accompanies this article, I put it on the sand. In as little time as it took me to take three more shots, the animal and its shell disappeared beneath the sand's surface.

Another gastropod, or single-shelled mollusk, whose body matches its shell is the olive shell. Like the music volute, the olive shell lives beneath the sand in the daytime, but unlike its cousin, its colors are more subdued. Still, it's interesting to find a trail in the sand, dig a bit at the trail's end, and unearth this polished shell. An olive shell left on the sand, according to my timed trials, takes less than 35 sec-

onds to completely rebury itself!

Bivalve mollusks, those with two shells, often have a body that is more beautiful and colorful than their shells — but here the trick is to get a photograph before the animal snaps its shells together. The giant clam is one of the most well-known mollusks in the world, and is becoming endangered due to overcollecting for food, rather than its shell in this case. These animals are essentially defenseless against collectors, and while diving the Great Barrier Reef I was depressed to find numbers of discarded giant clam shells, one half of each pair broken so poachers could remove the animal.

Thus it's particularly rewarding to be able to collect the animals with a camera, and even more so because the animal is so beautiful. Encased in a plain white shell, the bodies of giant clams are brilliant blues, greens and yellows.

Probably the most photographed Caribbean bivalve is the so-called flame scallop, or rough lima (*Lima scabra*). These animals also have uninteresting shells, which protect a brilliant red body. When feeding, the flame scallop displays tentacle-like extensions of its mantle which are also colored brilliant red. Other bivalves have colorfully patterned bodies that would credit any roll of color film.

All shells should be left on the reef to continue their lives and be available for others to photograph. You will find there is considerably more challenge to photo collecting than filling a goodie bag. And commensurate with the effort are the rewards: a greater knowledge and understanding of the marine environment, and a permanent collection of living shells. **S**

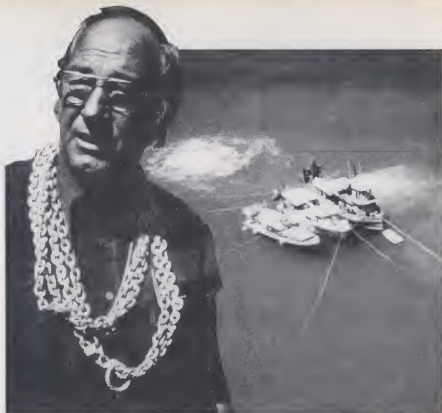
The charts are put away and the research books are closed — the greatest sunken treasure of modern times has been found! In retrospect, the search for the *Atocha* was one of the most intriguing treasure hunts ever undertaken. The story contains all the elements of a great adventure; monumental research, thousands of miles of magnetometer searching, tragedy, political intrigue, tantalizing clues and the relentless drive of a single person — and finally, the pile of gold and silver at the end of the rainbow.

Just a year ago, the first of the final clues fell into place. On a routine day of searching last February, Fay Field was being towed behind one of the smaller search boats of Mel Fisher's navy. It happened to be one of those days when the bottom was clearly visible at 50 feet. About a mile northwest from the main excavation site Fay spotted a bronze cannon partially exposed and bearing what later proved to be *Atocha* markings. The discovery altered the direction of search. As the 165-foot *Saba Rock* began digging holes southeast of the cannon, two ballast stones were found over half mile away. According to Fisher, the *Atocha* had to have passed over the spot.

On May 24th the *Saba Rock* dug yet another hole in the bottom, but in this one divers found 13 gold bars, 500 silver coins, 2 gold rings and 26 feet of gold chain. The UP wire service reported it as a \$1 million find. The excitement was genuine in the Fisher camp; they knew they were getting close.

On July 20th, diver Greg Wareham swam down into the crater-like hole and tapped his buddy on the shoulder. When Andy Matrocci turned around, he knew that Greg had found something great. With eyes as big as saucers, he beckoned Andy with his finger to follow. Matrocci had just found a large scattering of silver pieces-of-eight and had put them in a net bag. He had over 100, but suddenly they seemed insignificant. He threw the bag down and followed Greg out of the hole. The visibility on the bottom that day was about 20 feet and, for a moment, Greg hesitated, looking across the bottom at a depth of 54 feet. Spotting what he was looking for, Greg flipped off with Andy in hot pursuit. Soon a low, gray reef, no more than two feet high but several yards long, materialized among the strands of mangrove grass and sponges. As the two divers approached the reef it took on the shape of a stack of dark grayish loaves of bread. The hairs on the back of Matrocci's neck bristled, he wanted to shout. Only gurgles and bubbles escaped his mouthpiece, but something like "Silver

Bob Weller is a retired UDT Officer in the U.S. Navy. He is presently a salvage diver in Florida and a freelance writer.



Mel Fisher sports the ultimate in gold chains. Three salvage vessels are nestled over the *Atocha* site.

# Atocha... The

Few will ever experience the thrill of finding untold riches as these men did.

BY ROBERT WELLER

bars, silver bars!" seemed to rumble from his throat. The two divers locked arms and rolled and tumbled about the bottom. The *Atocha*, the greatest sunken treasure of all times, had been found! The scenario on board the 65-foot salvage vessel *Dauntless* was bedlam. Throughout the years of searching, the Fisher team had been looking along an extended straight path to the southeast. In an area of open ocean with no visible landmarks, a wreck-site 54 feet deep can easily be missed by a few hundred yards, let alone a mile or more. But when Fay Field had located the tenth bronze cannon, well over a mile beyond the Bank of Spain, the scatter pattern took on a curved track to the north. By extending the curved path more to the east from the location of the original nine bronze cannons recovered in 1975, the chase to find *Atocha* was on!

After the *Saba Rock* had hit the hole full of gold bars, Kane Fisher, Mel's youngest

son and skipper of the *Dauntless*, set up a 3½-mile track of buoys along this new path *Atocha* had possibly taken in 1622 when the hurricane tore her upper gun deck away from the main hull and sent it dancing across the waves. Kane began leap-frogging down the line of spar buoys in 100-foot jumps, digging holes with the blower and doing circle searches with hand-held metal detectors. Every hit had to be checked out, and soon the stern of the *Dauntless* was covered with Navy bomb fragments from WWII target runs, and other modern trash that had been dumped in the area. By July the end of the 3½ mile of spar buoys had been reached and still no sign of *Atocha*. Kane decided to extend his search beyond the last buoy. Late in the afternoon of Friday, July 19, and one mile beyond the last buoy, Kane and Steve Swindell made the final circle search of the day. Off to one side of the search path they got a detector hit and fanned up a metal barrel hoop just



below the layer of silty bottom sand and shell rock. Nearby was a pottery shard, and more importantly a ballast stone. Once on deck the divers agreed the barrel hoop and pottery shard could have floated into the area, but the ballast stone was a more obvious sign that they were on the right track. During the initial excitement Andy Matrocci noticed a silver piece of four lying on deck. He picked it up and walked over to Kane. "Did you find this?" Kane shook his head, as did Steve. Only then did they begin to more closely examine the encrusted barrel hoop. Stuck to the coral were three more silver pieces of four! It was fast approaching darkness but the *Dauntless* sprang to life. Kane ordered the anchor lines taken in and the boat was moved over the spot where the hoop had been recovered. As the sun sank below the horizon the *Dauntless* engines burrowed a fin hole into the bottom below. As the divers descended to check it out, they were greeted by a sight that makes all treasure divers numb with excitement — over 3,000 coins, barrel hoops and pottery shards filled the hole!

moved 10 more feet and blew hole #3. Bill Moore and Jack were the second pair of divers in the water, and when they reached the bottom the morning shadows were just disappearing. In their entry the *Dauntless* log indicated "Unlimited coins!" After the fourth hole the log entry was "Hundreds of artifacts." The third team of divers to the bottom was Andy and Greg. The fifth hole was full of silver coins, silver plates and artifacts. Andy swam out of the hole in one direction and Greg in another. Within a few seconds Andy was back and began putting coins in his net bag. A few minutes later Greg tapped him on the shoulder and they swam the 40 feet to the mother lode!

Andy broke the surface and shouted "Mother lode, mother lode!" The divers still on deck let go, jumping and shouting "*Atocha*, *Atocha* — we got it!" Kane Fisher somehow found some sanity in all this as he climbed up into the wheelhouse and flipped on the marine radio. "Home base, this is *Dauntless*. Come in." Soon, home base, 35 miles away in Key West, Florida, answered, "Go ahead *Dauntless*."

With a great attempt at composure, Kane gave the following message, "Put the charts away, we've found the *Atocha*." Within minutes all of Key West knew the *Atocha* had been found, because in trying to locate Mel Fisher, the local radio station issued the announcement every five minutes, "Mel Fisher, please call your office. You've found the *Atocha*." Mel got the word in a local dive shop and ran the few blocks back to his office.

As the story unfolds and each diving day brings more treasure from the bottom, the pot of gold at the end of the rainbow is greater than anyone ever thought possible. At this writing it contained a five-foot high reef of silver bars weighing 70 to 100 pounds each, boxes of silver coins stacked as high as a diver's head, silver service from the Captain's table, with an "A" inscribed on each piece, 73 gold bars, 5 gold discs, gold coins, and much, much more. That first night, Mel Fisher sat in his living room with one of his divers, and this usually somber, smiling man wept. John Brandon, knowingly, said nothing, and Mel offered only, "I guess I'm just happy." Mel, you've earned it. . . \$

# Moment of Discovery

It was too late to dig any more, all they could do was wait out the night. It was impossible to sleep. At 3 a.m. Andy was getting a glass of milk and cookies from the galley when he bumped into Kane. "What are you doing up?" he asked. "Same reason you're up I guess," Kane answered. On the fantail they found two of the other divers drinking coffee and speculating just how close the *Atocha* was. None could have realized they were only 40 feet away! Before dawn the entire crew was on deck pacing and hollering, "Come on sun, rise and shine!" At the bottom depth of 54 feet, each diver pair was able to check out two holes before running out of air, or going into decompression time. At first light the engines rumbled and the waterspout from the blowers began digging at the sea bottom still dark below. It was 6 a.m. when Bill Barron and Scruggs went over the side to check out the first hole. In the hole they found 27 coins, 2 copper 50-pound ingots and 2 square spikes. The contract to build *Atocha* in 1620 called for square spikes. The second hole produced 22 more coins, 12 copper ingots and more pottery shard. The *Atocha* manifest indicated 45 tons of copper ingots consigned to the foundries of Spain to cast bronze cannons. The *Dauntless*

Divers remove silver bars from lifting basket to the deck of the *Dauntless*.



Photos by Phil Byrne of Treasure Salvors

# SCUBAPRO Trivia Quiz



**T**ime for Round Three. Are there any survivors? Sure, the questions are tough but aren't you getting smart? — and insufferable! If you ace this one you should be submitting questions and SCUBAPRO cordially invites you to do so by sending them to the Trivia Editor, c/o S.E.A. SCUBAPRO Educational Association, 3105 East Harcourt St., Rancho Dominguez, CA 90221.

1. Ok. Let's see if you were paying attention last time. The product names Pinocchio, Ostrica and Squala were among the first products in what category?

2. What does the term "hookah" refer to in diving equipment?

3. More "hookah" ... what is a "hookah" literally? No fair checking your dictionary.

4. What is the difference between a breakwater and a jetty?

5. What do the names Poseidon, Neptune, Triton and Proteus all have in common?

6. How deep is the record dive with SCUBA?  
337 feet      437 feet      537 feet

7. More record stuff. What is the world record for voluntarily staying underwater (breath holding)?  
\_\_\_\_ over 5 minutes  
\_\_\_\_ over 10 minutes  
\_\_\_\_ over 15 minutes  
\_\_\_\_ over 20 minutes

8. Which of the following materials are completely corrosion resistant in salt water?  
\_\_\_\_ stainless steel  
\_\_\_\_ brass  
\_\_\_\_ titanium  
\_\_\_\_ silver  
\_\_\_\_ gold  
\_\_\_\_ aluminum

9. What is the main raw ingredient in silicone as in silicone masks?  
\_\_\_\_ rubber  
\_\_\_\_ petroleum  
\_\_\_\_ plastic  
\_\_\_\_ sand

10. Hey, this sure isn't pure diving but divers should know some nautical history. Match the captains with their famous ships.

- |                            |                        |
|----------------------------|------------------------|
| a) Captain Cousteau        | _____ Bonhomme Richard |
| b) Captain Bligh           | _____ Nautilus         |
| c) Captain John Paul Jones | _____ Pequod           |
| d) Captain Nemo            | _____ Calypso          |
| e) Captain Ahab            | _____ H.M.S. Bounty    |

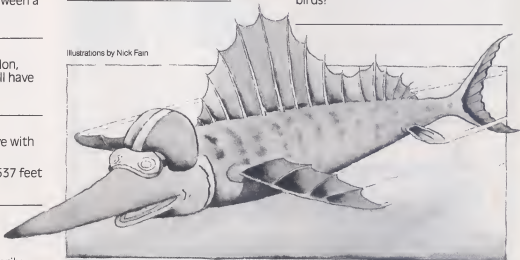
15. What is "Sea Fire"?

16. Last issue we asked how long a polar bear can stay underwater. Do you remember?

17. Ok. How fast can they swim?  
\_\_\_\_ 1 mile per hour  
\_\_\_\_ 3 miles per hour  
\_\_\_\_ 6 miles per hour  
\_\_\_\_ 55 miles per hour

18. What is the largest of all diving birds?

Illustrations by Nick Farn



11. More nautical trivia ... Why were old time sailors, particularly the British, referred to as "Limeys"?

12. What is the fastest swimming fish?

13. Were the first fins manufactured for diving full foot, solid heel strap or adjustable?

14. SCUBAPRO Product names — match 'em. No, you can't use the catalog.  
a) Shotgun      \_\_\_\_\_ Beris  
b) Spectramar      \_\_\_\_\_ Snorkel  
c) Panther      \_\_\_\_\_ Fins  
d) Air      \_\_\_\_\_ II  
e) Jet      \_\_\_\_\_ Speargun

19. Ok, nautical persons. How far is a league, as in "20,000 Leagues Under the Sea"?  
\_\_\_\_ 3 feet  
\_\_\_\_ 3 yards  
\_\_\_\_ 3 fathoms  
\_\_\_\_ 3 miles

20. The last one is a "gimme". What diving manufacturer introduced the first silicone diving masks?

SCUBAPRO reserves the right to be wrong. We think we are correct but if you feel we have blown one, let us know. Check your answers against the ones on page 50. Now total your correct answers. If you scored:

0-4 You're just blowing bubbles.

5-10 You should have that "sinking feeling."

11-15 You've earned the gentleman's "C."

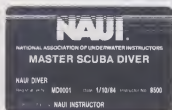
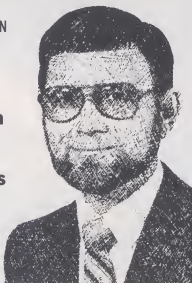
16-20 You're a certified quiz whiz.

# ONE

IN A SERIES OF INTERVIEWS WITH  
THE LEADERS IN DIVING EDUCATION

**"Continuing education  
is the key which  
opens the door to  
marvelous experiences  
underwater."**

Dennis Graver, noted diving educator, has been employed as a professional by both NAUI and PADI, and is a prolific author of books, manuals, articles and columns on diving. "Diving is a means to an end rather than an end in itself. It is a vehicle which allows you to do things in a wonderfully different world. You need to know more than just how to dive. You need advanced and specialty training. . . . to master diving in order to experience all it has to offer. Now there are excellent courses available. Get all the training you can to get all you can from your training."



## MASTER SCUBA DIVER CERTIFICATION

Sport Diving's most demanding and rewarding program. NAUI's new Master Diver Certification is

for the active diver who wants to achieve the pinnacle in aquatic proficiency. You will develop instructor-level skills and knowledge while training for the Diving Industry's most prestigious and challenging sport diving certification — NAUI Master SCUBA Diver.

## THE QUALITY DIFFERENCE

NAUI Certification, sport diving's most respected SCUBA instruction. For 25 years, NAUI's uncompromising standards and curriculum have been admired and imitated throughout the industry. Our courses, from the "Entry SCUBA Experience" to the highest and most prestigious certification, "Master SCUBA Diver," are recognized throughout the world as the finest and most complete available. Expand your SCUBA training and knowledge, join one of NAUI's 27 comprehensive "Continuing Education Programs." Courses are beginning today at leading Dive Stores, Universities and Community Recreation Centers. For the name of your nearest NAUI Educational or Dive Store Pro Facility, contact NAUI Headquarters and find out why our goal is continuing your education.



**NAUI HEADQUARTERS**  
4650 Arrow Highway, Suite F-1  
P.O. Box 14650 • Montclair, CA 91762  
(714) 621-5801

## Answers

1. They were all dive masks first manufactured in the 1950s.
2. "Hookah" commonly refers to a regulator second stage used with a surface supply such as a low pressure compressor or volume storage tanks. They are commonly used in gold diving in streams or boat hull cleaning operations.
3. A hookah is a tobacco pipe with a long flexible tube by which the smoke is drawn through a vase of water and thus cooled.
4. A breakwater is a barrier that breaks the force of waves, generally parallel to the shoreline. A jetty is a structure of stones, piles or the like projecting into the sea or other body of water so as to deflect the current, etc. A wharf or landing pier could also be considered a jetty.
5. They are all mythical sea gods.
6. The Guinness Book of Records states the record dive with scuba is 437 feet by John J. Gruener and R. Neal Watson off Freeport, Grand Bahama on October 14, 1968.
7. Robert Roster, aged 32, an electronics technician of Richmond, California, stayed underwater at a depth of 10 feet in a swimming pool for 13 minutes 42.5 seconds on March 15, 1959. He hyperventilated with oxygen for 30 minutes before his descent.
8. Titanium and gold.
9. Sand.
10. C Bonhomme Richard D Nautilus E Pequod A Calypso B H.M.S. Bounty
11. Because of the quantities of limes they carried onboard and consumed to prevent scurvy.
12. The fastest fish in the world is the sail fish which has been clocked at 67.7 miles per hour.
13. Solid heel strap.
14. B Beris A Snorkel E Fins D II C Speargun
15. "Sea Fire" is a weak, fluorescent-like glow emitted by certain deep sea fishes at night.
16. Approximately two minutes.
17. Polar bears swim, using their front paws as oars, at about six miles per hour, and they can go non-stop for a hundred miles.
18. If you said pelican you are wrong. It is the Emperor Penguin that inhabits the Antarctic.
19. Approximately 3 miles.
20. SCUBAPRO introduced the silicone mask in diving in 1975. Now known as the Crystal Series, they were originally called H/T for Hypoallergenic/Translucent. **S**

also thought to be the fountain of youth that lured Ponce de Leon, the Spanish explorer in 1521. Unfortunately, he met his death in a battle with the natives.

### Traffickers Of Fossil Ivory

In the fifties, an American team of divers discovered the first sunken bones in Christmas Springs. Unfortunately, an accident stopped further searching as the owner of the land feared lawsuits. Armed guards patrolled the area.

But such sunken wealth did not go unnoticed. If the beauty of the site makes divers dream, the ivory tusks lure the unscrupulous.

Some "elephant fishermen" didn't hesitate to sneak to the spring, tanks on their backs, through a one kilometer swamp infested with water snakes. Others rowed up the river during the night for four hours through a jungle of aquatic cyprasses. Many were put to flight by gunshots.

Another thief, more wily, was caught getting out of the water. Having rented a room in a nearby motel, he had worn very large pajamas over his equipment. From afar, in the darkness, he could be mistaken for an overweight insomniac.

### A 10,200-Year Old Human Brain

Dozens of scenarios have been proposed to explain the presence of fossils at the bottom of the Floridian springs: a frozen pool breaks at the passage of the herd; a natural sanctuary where weak animals commit suicide as in Africa; some divers who believe they discovered the remains of campfires and engravings on the walls, feel the caves were once dry. If so, the men who lived there could have used the bones for a religious purpose.

"Absurd!" cries Wilbur Cockrell, a young archaeologist. At Wakulla, Cockrell says there was always water, perhaps the level was four meters lower, but the animals fell in by accident.

"Sonny" Cockrell became famous a few years ago when he discovered a human skull, 10,200 years old, which still contained the soft brain! The find was made in Warm Mineral Springs, near Sarasota. The skull was preserved owing to the absence of oxygen in the water.

Cockrell's next project, sponsored by Senator Johnson and the Manatee Community College, consists in excavating the silt cone in Warm Mineral Springs, with the hope of discovering an intact body!

### Eaten By Alligators!

Many Florida caves are closed to divers for numerous reasons. But as we were preparing to make a movie for French TV, we received permission to visit the most famous one: Wakulla Spring, with its many alligators.

Alligators don't normally attack men,

except to protect their young. But we are at Wakulla during the nesting period! On the front page of a newspaper, we read the awful story of an eight-year-old child devoured by an alligator. A friend of mine found only the collar of his dog on the bank of a lake. I recall two divers who, some years ago, were attacked during their decompression stop.

Two days ago, I had the opportunity to taste a piece of fried alligator tail. The flesh is red, hard as rubber, with a fishy taste — rather disgusting.

Today, as I enter the water, I feel as if all the reptiles of the spring fix me with their patient stare. They know my crime and wait for the time of revenge. With their white teeth protruding over their jaws, they seem to smile!

We approach the edge carefully. A couple of 10-footers are nearby but seem to be asleep. The water is full of eel grass which binds our legs. We were less than six feet away when their eyes opened wide. And then, as if in a slow motion picture, the two alligators hoisted up on their legs and lunged into the water in our direction.

I get a terrible slap on the leg and I know Veronique did not give it to me. Escaping into deeper water, my aggressor swims away with its powerful tail. No sign is seen of the other which must be hidden in the algae. I follow the first with my camera clicking. I feel protected, like a hero!



This fossilized tooth of an ancient giant shark was found in a Santa Fe River spring

But the animal stops and turns back — its maul toward me. I give up. I have the goose flesh as I realize that during this stupid incident, I could have lost my wife, one of my legs or worse, my exposed film. **S**

Mastodon jaws have been discovered in several of Florida's underwater caves and springs





As if there isn't enough to see during the day, the Red Sea presents Act II at sunset.

# The Red Sea After Dark



A masked pufferfish reacts to having its sleep disturbed.

BY DEE SCARR

**A**t first, it seems strange a creature called a Spanish dancer should live in the Red Sea, far from anything remotely Spanish. Yet one look at this creature's behavior makes the nomenclature clear. When our dive lights disturb it, rather than crawling away from the light as the other mollusks I've met on night dives have done, the Spanish dancer undulates its body and ripples — dances — its way off the bottom and out of the light's beam. In my mind the sounds of castanets accompany its movements. The name Spanish dancer seems very fitting.

The discovery of the Spanish dancer came at a time every underwater photographer knows well — seconds after we ran out of film. This was also the last night dive of our Red Sea trip.

Like many divers, I'd dreamed of diving the Red Sea for years. I'd never forgotten Dr. Eugenie Clark's comment in the September 1975 *National Geographic*: "Yet if I could choose only one spot in the world [to dive], I would choose Ras Muhammad." That was more than enough recommendation for me, but it took me nine years to finally experience diving the Red Sea.

These days there are three ways to dive the Red Sea. Two of them are land-based: divers can stay in hotels in Egypt and travel to the reefs daily by boat, or camp along the coastline and dive directly from the shore, or combine both. The third option is a live-aboard boat. Since I'm basically lazy, hate sand in my diving and photography gear, and don't do much on a dive vacation except dive, a La Mer Diving Safari was the obvious choice for me.

The other reason I appreciated a Red Sea dive trip aboard Howard Rosen-

stein's *Fantasea* was the safety factor. One reason why Red Sea reefs are so lush is the ample supply of nutrients the water movement in the Red Sea provides. The other side of that coin, of course, is that divers must deal with strong currents virtually all the time. The *Fantasea* is equipped with two inflatable dinghies ready at a moment's notice to fetch divers in the grip of those currents.

This safety factor was a particular comfort on night dives. I couldn't help but think what it must be like to do a Red Sea night

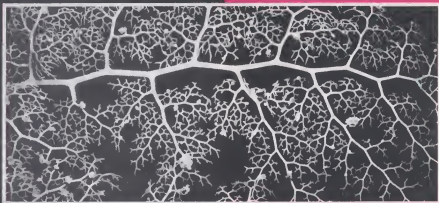
dive in anemones, lionfish and some crown-of-thorns starfish at dusk... but not the nocturnal Spanish dancer.

But the decision was made, the camera prepared in record time, the shower and dive log postponed until after dinner, and I found myself in the water again.

It wasn't only the thought of a Spanish dancer that got me in the water that night, and those to follow, but the knowledge that night diving gives me a more complete understanding of what life is like for reef inhabitants. Only by night diving could I have learned, for example, that a brownish lump can turn into the beautiful Caribbean orange ball anemone, or that brick-red clusters of tiny cups can expand their polyps and become the brilliantly colored orange cup corals. I wondered what surprises the Red Sea would have in store for me.

The most obvious nocturnal animals on a Red Sea reef are the basketstars and crinoids. Opening their many arms into the current, they spread out like so many colorful nets to collect plankton. I can't help comparing them to their Caribbean relatives: they look the same, but some are colored black instead of that Crayola "flesh" color Caribbean crinoids don't seem to be affected by light levels and stay in the same places in the daytime and at night, but the crinoids in the Red Sea hide somewhere during the day and only begin to move into the open as dusk falls. When I pick one up it begins to undulate its arms and "swims" away from me — an ability I've never seen a Caribbean crinoid display.

Also "out" for the night are several dif-



Knots on the lacy arms of a basketstar, above, show where plankton has been trapped. Opposite are orange cup corals.

dive from the desert shore.

Of course, what's really important is not how one gets to the Red Sea's reefs after dark, but whether the dive is worth the effort. I considered this carefully after a three-day day. It was awfully tempting to pass on the night dive, take a shower, finish my dive log and prepare my cameras for the morrow. After all, most of the animals I'd wanted to see in the Red Sea I'd found with no trouble in the daytime:

ferent types of sea urchins, grazing on algae here and there. I suppose the majority of echinoderms are nocturnal no matter what ocean they inhabit.

The next creature I notice is a crown-of-thorns starfish, and as I turn in a circle, I realize several of them are in this one place, moving along the surfaces of a stony coral head. Although the crown-of-thorns does have venomous spines and a rotten reputation, it also has a soft rose

(Please turn to page 78)



BY CATHIE CUSH

# A Field Guide to Dubious Denizens of the Deep

**T**he earth's vast oceans hold secrets so unfathomable, so complex that none but the most learned scholars and a handful of producers of public television documentaries attempt to unravel them. Yet as a growing number of sport divers visit this dark and mysterious realm, the thirst for knowledge grows. There are strange lifeforms to identify, behaviors to observe, surroundings to study . . . and then there's that damn thirst. Important scientific discoveries are delayed when the researchers must frequently return to dry land in search of liquid refreshment. After a few pitchers, the divers' ability to make fine distinctions becomes blurred and the reliability of their reports must be questioned.

It's a wonder, then, that we have as much information about the marine environment as we do. And with what we know now, it's a wonder that divers are still suiting up and heading beneath the waves. There are some bizarre critters down there.

Recently there have been a number of important discoveries. Although the existence of many of these creatures has long been suspected, it is only since sport diving's popularity has grown that divers have been able to make positive verification.

Lobster divers have been instrumental in gathering important information about several fascinating marine species. A member of the lobster family, *Crustaceus deliciousus shrinkae* is found wherever its cousins, the Maine and spiny lobsters, are found. Closely resem-

bling its relatives, this unusual bug hides in hole and entices unwary divers to use up precious time and air trying to grab the critters. They do this by blowing themselves up to several times their normal size. Then, as the diver fumbles about, the lobster reduces its size substantially. Sometimes this allows it to crawl even farther back into its hole, out of the diver's reach. If the diver does manage to bag the bug, the shrinking process continues. The diver returns to the boat only to find that what he thought was dinner for two is now not quite big enough for shrimp cocktail.

Less frequently encountered is *C. delirious crunchii*, a two-clawed species that at first glance resembles a 2 to 3-pound Maine lobster. In actuality, these creatures weigh about 35 pounds and have two crusher claws. Their favorite prey is doctors, artists, typists and others who earn their livelihood with their hands.

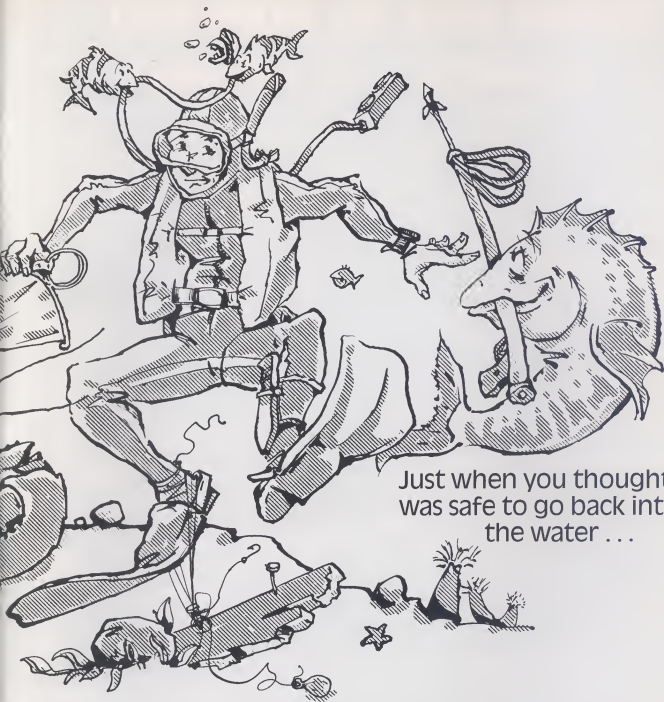
Divers have often been mystified by the lack of lobster at supposedly good lobstering sites. It's now believed that *Harum scarum Reverii* warns lobster when divers are about to enter the water. Normally invisible to the naked eye, the animal moves in great colonies. These are known to turn brown, lowering visibility to near zero, in order to discourage a diver who has wandered too close to an occupied lobster hole. They also do this when an inexperienced or overweighted diver swims too close to the bottom.

The so-called "discovery" of *Pisces gigantus escapii* is still shrouded in con-



Illustrations by Nick Fain

trovery. Although numerous divers, especially spearfishermen, claim to have seen the fish, no one has yet to bring a specimen into captivity. Witnesses claim the animal is huge, growing as long as a man's outstretched arms. Experts believe that, when first encountered, *Pisces* is about 18 inches to 2 feet long. But the fish seems to have an intriguing ability to grow even after the diver has finished the dive. This would account for the fact that each time a witness reports a sighting of a given *Pisces*, its size seems to increase. When non-divers are within earshot, these fish seem to get particularly large.



Just when you thought it  
was safe to go back into  
the water . . .

Pisces has an uncanny chameleon-like ability to take on the appearance of several types of popular game and food-fish, only much larger. Mid-Atlantic divers have reported specimens resembling doormat-size flounder, while divers vacationing in the Caribbean have returned home with tales of grouper-size fish the size of a four-bedroom, two-bath colonial in the suburbs.

The existence of this species, whose Latin name roughly translates as "the big one that got away," had been suspected by topside fishermen for many years.

Prime fishing areas are popular feeding grounds for the feared Monofilament

tieruppus. Sprouting out of gray, lead-like egg cases called sinkers, this slender, nearly invisible animal can snare an unsuspecting diver in less time than it takes to say, "Where's my Scubapro knife when I need it?" Graceful creatures, they wind their way in and out of fin buckles, through tank valves and around limbs, often tying themselves in knots to secure their hold. Once they entrap a victim, they multiply instantaneously. While juveniles are toothless, adults have barbed teeth long enough to penetrate neoprene.

No diver has ever seen the annoying Elusivus wreckus. There is much specu-

lation about this fish, which is known primarily for its ability to make finding known wreck sites extremely difficult. Divers have had to sit, geared up and overheated, for hours at the hands of this cruel beast. Until recently divers blamed inept captains and faulty navigational equipment. Now scientists speculate that Elusivus, which lives beneath wrecks, reefs and moorings, simply moves when it hears the engine of a boat, carrying its hiding place with it to a new location.

Objectus magneticus also delights in disturbing the navigational abilities of underwater explorers. This microscopic



creature, a close evolutionary relative of the lodestone, dances playfully on the wrist or console of a disoriented diver, causing his or her compass needle to spin dizzily. It is especially abundant near wrecks, and is more active when the compass is not held level.

**Objectis** is one of many creatures known to both saltwater and freshwater divers. On the other hand, the dreaded quarry shark is found only in landlocked bodies of water, and is known for its unusual ability to trick a diver's digestive system into believing it has consumed nothing but prunes for a 48-hour period. Descriptions of the animal vary, but most say it is large and dark. It's probably responsible for more rapidly terminated divers than Peter Benchley and Steven Spielberg combined.

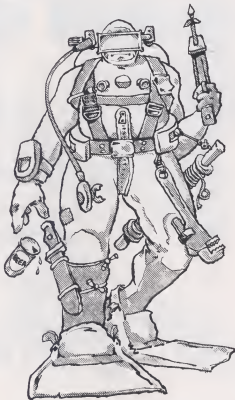
Novices report more encounters with the quarry shark than do more experienced divers. It may sense vulnerability, as it also seems to harass tired or hung-over divers. It usually appears out of nowhere just at the edge of a diver's field of vision, disappearing before he or she can get a good look at it. Sometimes the quarry shark will be so bold as to touch the diver. In fact many divers have been touched and lived to tell about it. Sometimes it taps; other times it seems to tug at limbs or stray equipment. A creature of amazing dexterity, the quarry shark is able to unfasten straps from watches, knives, wrist gauges and the like. The best way to ward off the quarry shark is to mumble throughout the dive. "There's nothing alive in here, there's nothing alive in here," or "It's just a sunfish."

A distant cousin of the quarry shark, the devil cave beaver is particularly abundant in the underwater wilds of northern Florida, where it thrives by scaring the bejeesus out of novice cave and cavern divers. Cavern specialty courses usually cover how to cope with the knotted stomach that accompanies sightings of these large, dark creatures.

Traveling divers meet the most interesting array of creatures — underwater, on land and in the air. The most feared of these is *Turísticas americanii*, a one-eyed beast that ranges in color from beet red to wildly floral or plaid. While in the water, the ungainly 6-foot creature merely crawls from one coral head to another with its nose buried in a guide to local marine life. Its golden eye flashes, temporarily blinding anyone who dares approach. On land, it can be spotted bumping from one T-shirt shop to another, its nose covered with a goeey white substance and buried in a guidebook to local souvenir stands and one-hour photo developers. If left alone it is not dangerous, but if provoked it has been known to fight back with photos of grandchildren, stories of cousins from

Peoria and requests to dine with the victim.

Surprisingly, divers encounter two species of simians in their travels. One inhabits airplane baggage compartments, where it searches out the most fragile piece of luggage aboard and uses it to practice jump shots and lay-ups. The other, *Mucho machicus*, is most often found on dive boats in the New York/New Jersey area. With two or more large metal cylinders growing from its back, it is often seen approaching the surface with its limbs hideously twisted. These humanoids are usually only dangerous to themselves but should be approached with caution, especially because some have a long, sharp silvery



spine with which they can stab fish or divers with equal abandon. They can be distinguished from human divers by the knives they carry between their teeth as they barrel down the anchor line.

The handiwork of a small organism known only as the wetsuit weevil is apparent at the beginning of each new diving season. Wetsuit weevils thrive on neoprene, which they consume greedily during the off-season. (Apparently they hibernate during the summer.) They cleverly eat only near the seams, keeping them joined as they go, so the damage is not discovered until too late. The first time a diver puts the suit on each season, it will seem to have shrunk one complete size. It is well known that the

food an individual eats can be detected through the sweat glands. These weevils seem to prefer suits that have been in contact with beer or junk food-flavored sweat.

Another topside pest is *Rodentis clegiticus* Fagin. This Dickens of a character has telepathic powers which it uses to determine which piece of gear a diver is going to need next and hiding it away in the most unlikely place possible. Fagin has a particular fondness for small items, although its tastes are really unlimited. Extremely agile, it can move small items from one of the diver's pockets to another while the diver is still dressed. The playful but pesky critter has also been known to wait until the search is finished and then return the item to its original location. Another favorite game is to root through the diver's gear bag, removing one item at a time over a period of several weeks or months. Very often these items — fin straps, compasses, lens caps, clips, small flashlights and the like — will be discovered in all one place a few weeks after the end of the dive season.

Such is the diversity of life in the underwater animal kingdom and in those other exotic places divers visit that it would be impossible to catalog all of it here. But no divers' bestiary would be complete without at least a mention of *Pachydermis rosatus*, a spectacular beast that has become a legend among members of the diving community. The colorful terrestrial creature was first spotted by a group of diving pioneers in the Caribbean who were quaffing libations while watching for a sunset phenomenon called the "green flash." Atmospheric conditions were apparently not right for the flash to appear. However, several hours later the divers reported seeing a large, wrinkly-skinned animal whose rosy color resembled the sunset itself. Since then, *Pachydermis* has been spotted often. It is known throughout the world. Its favorite feeding ground seems to be near thatched-roof palapas, especially those over poolside bars in small tropical getaways. Researchers believe it thrives on an unusual combination of coconut milk, pineapple juice and the fermented syrup from the sugar cane. But this versatile animal knows no bounds. It has been spotted as far north as the Great Lakes region, where its diet consists mainly of pretzels and a beverage brewed from barley and malt.

Divers everywhere should keep their eyes open for all these strange and wondrous creatures with whom they share their environment. Hopefully, a little knowledge about their habits and lifestyles will make them easier to spot and thus bring about a greater enjoyment of the diving experience.



# The skin of this beast makes it a beauty...

"Double Blue" is the tough, new Scubapro Stabilizing Jacket coated outside and inside with neoprene "skin." This double "skin" protects the jacket from abrasion and covers a 420 denier nylon packcloth for the utmost in durability. All seams are hand bonded with special cement, internally and externally taped for triple

leakproof protection. Instead of a vest that is "easy-to-repair," Double Blue is practically repair-free, ensuring you years of carefree diving. Add the same features as the popular Scubapro Stabilizing Jacket, and you've got a beauty that's one tough beast. Double Blue is for the serious diver from 80 lbs. to 300 lbs. We make it tough, so you don't have to be.

## SCUBAPRO DOUBLE BLUE STABILIZING JACKET

### SCUBAPRO®

3105 E. Harcourt,  
Rancho Dominguez,  
CA 90221.

100-page Equipment  
Selection Guide and  
Scubapro Diving  
Adventure  
Magazine  
available  
at Scubapro  
Dealers.





# Sinking Treasures

BY YVETTE CARDOZO AND BILL HIRSCH

## Artificial reefs are creating an underwater paradise off the Florida coast.

**A**t the anchor line we took a quick look at the cloudless sky and began sliding down into the pea green gloom.

The water closed around us and we continued on down in the murky haze and slowly, a dark shadow formed below. At 75 feet, the wheelhouse of the sunken tug *Orion* emerged. The overhead and walls were visible and below, we could faintly see the rest of the ship. The eerie feeling that we had come upon a ghost ship in the fog was unshakable.

But the feeling was soon dispelled. Every inch of the wheelhouse was encrusted with lavender sponges and the wreck was far from lifeless. Hanging just outside the wheelhouse we could see the interior was filled with yellowtail snapper. Hundreds of them, each no longer than six inches, swam in a silvery ball.

For just a minute we watched, then turned sideways and eased ourselves through the wheelhouse windows. The cloud parted, then closed behind us.

From the wheelhouse, we swam down to the deck where we found a hatch and ladder. We threaded our way through the ship, winding up in the dark recesses of the engine room. Later we shined lights on the outside of the metal hull and watched the beams play on a solid carpet of brilliantly colored soft corals and gorgonians.

This was wreck diving at its finest and we were neither abroad nor far offshore. The *Orion* is just a sample of what lies along the Florida coast.

Until only a few years ago, this dive did not exist, nor did many wreck dives scat-

tered along the coast. Artificial reefs are a brand new tourist and sport industry which now stretches from the northern Keys through Palm Beach County and includes more sunken odds and ends than even county officials running the programs can count.

For fishermen, the wrecks off Miami have been a treasure trove for years, beginning when the Pfeuger taxidermy firm began sinking boats under permit in 1969 and unofficially for years before as the occasional pot boat was scuttled or


anglers slipped out under cover of night to sink wrecks.

Fish aren't choosy about their homes. Anything sticking up from the bottom will do — bales of tires, sewer pipe, cars and especially, old boats. The bigger the object is, the better, says Ben Mostkoff, coordinator of Dade County's artificial reef building program in Miami.

What happens, Ben explained, is water flows around the sunken object, setting up a pressure wave. Fish have a "lateral line" they use to sense pressure changes.



Yvette Cardozo has been diving since 1962. Her husband, Bill Hirsch has recently taken up diving. They have co-authored many articles in the travel field.



For fish, a pressure change means shelter and food. So they come in droves. Meanwhile, algae start growing, followed by barnacles and soft and hard corals. Soon, there's a full fledged, teeming reef where only barren sand once existed.

Actually, artificial reefs are not new. The Japanese have been building them for commercial fishing for 200 years. Even Florida has been in the business since the twenties when a battleship and some concrete rubble were sunk in the Gulf of Mexico off Pensacola. A steel tanker and

dredge pipe were sank in 60 feet of water off Jacksonville and a 100-foot crane boom off Miami in the 1940s.

But serious reef making didn't start until the late 1960s. Before then, the Navy stopped most efforts. Navy brass were afraid artificial reefs would provide cover for enemy submarines. Locals around Miami swear this resistance melted miraculously after an admiral went along on one whopper of a fishing trip over an artificial reef.

Whatever the truth, the Army Corps of Engineers suddenly started issuing artificial reef permits in 1968.

Folks up in Palm Beach got out there first, sinking a variety of odds and ends including a 140-foot freighter, an old bridge and the granddaddy of modern south Florida sport wrecks, a 185-foot yacht called the Mizpah. For years, the faithful from as far away as Miami made regular pilgrimages to root into its dark crevices.

Most of Miami's early wrecks were intended for deeper waters; 200 feet and more. This, said fish experts, was best for large game fish — amberjack, huge grouper and the like. Deeper waters also kept away the divers, whom some fishermen saw as competition.

Not everything goes as planned, however. It's not all that easy to pull the plug on a large ship and have it land exactly where you want it. For one thing, the continental shelf rises steeply so a mistake of, say a couple hundred yards may make a large difference in how deep a wreck winds up. Thus, more than one of those early wrecks landed in thinner waters than intended. The Biscayne, a 120-foot freighter sunk in 1974, settled at only 55 feet. Presto, a new dive site was born.

In 1981, Dade County set up an agency just for building reefs under the county Department of Environmental Resources Management (DERM). A bunch of rotting derelicts sitting along the Miami River were soon being dragged out to sea and

sunk by DERM.

Divers in Broward County took notice. Soon enough, there was a Broward Artificial Reef Program under the county's Environmental Quality Control Board. And after the Mercedes went in Broward waters in March, Palm Beach joined in with its own county run reef program. "We didn't want to lose anything else," grumbled a Palm Beach dive shop owner who helped organize the reef committee.

Today, there are plenty of wrecks for fishermen and divers. Both groups are actually smiling at each other (when they're not running around trying to figure out who gets the next wreck).

Down below, it's beginning to look like a junkyard, what with the 20 cement mixer bowls, the crane boom, tires, concrete rubble, a pontoon dock, a bridge, assorted toilets and 56 boats ranging from small yachts to the 435-foot *Mazon*. Actually, hard tossables litter the length of the state. In fact, Florida has one of the largest if not the largest artificial reef program in the U.S. But mostly, wrecks outside the southeast coast are aimed at the angler crowd.

Ship sinking has become a science in itself. You've got to prepare the ship to make it diver safe. This includes pumping out fuel, tearing out all wood, cables and anything else that could disintegrate or tangle divers, removing hatch covers, blocking off areas too small for comfortable entry and exit, making sure all other compartments have at least two exits, and cutting holes in the hold areas to maintain fresh waterflow which promotes marine growth.

When all this is done, you've got to schedule towing (and press boats), get the right kind of anchor and then determine wind and current so the ship goes where you want it.


The final result is a safe wreck for diving. In other places, diving wrecks means multiple lights, guide lines, tying hatch covers open . . . essentially mounting the



## Gulf Coast

### Complete Diving Centers For Scubapro

<b>Skippers Diving Center</b> 904-434-0827 408 East Wright Pensacola, FL 32502	<b>The Scuba Shop</b> 904-863-1341 230 N. Elgin Ft. Walton Bch., FL 32548
---	--



## Buy Duck Stamps

**for the FUTURE of WATERFOWL**

At most Post Offices and National Wildlife Refuges

kind of expedition one usually does for diving caves. With the most recently sunk wrecks off South Florida, much of that is unnecessary.

So much for the sinking. Once down, a ship quickly becomes a haven for life. The *Bluefire* settled south of Miami in 1983 and already, coral is growing. In five months, the *Mercedes* has grown so much algae hair, you can't read her name. Older wrecks, like the *Biscayne* and *Almirante*, are covered with lush carpets of rainbow colored soft corals. And hidden around steps somewhere on the *Orion* are sprigs of black coral.

Shallow wrecks draw schools of small fish, sometimes clouds so thick you can't see through them, while deeper wrecks bring the big fish — amberjack, grouper, even jewfish.

Up to now, Miami has had the most active program for sinking wrecks, but no longer. Ft. Lauderdale scored the public relations coup of the decade when it snared the *Mercedes*. Lots of ships go aground but the *Mercedes* picked the seaside backyard of Palm Beach socialite Mollie Wilmut. As the weeks dragged on and the 197-foot freighter stayed stuck, the story got bigger and bigger. Finally, after 105 days, the ship scraped free. And immediately, Broward's reef building agency grabbed it.

By the time the *Mercedes* settled in 97 feet of water off Oakland Park Boulevard, the entire affair had become a community cause. The project had 27 sponsors including Chevron and Goodyear, who chipped in time and money. Sixty members of a local dive club worked weeks to clean it up and in the end, the price tag to sink the *Mercedes* came to \$29,000.

More than a community cause, the *Mercedes* became a "happening" that drew newspaper reporters and network TV folk from across the country. *Mercedes* T-shirts went for \$8.50 a pop. An 82-foot luxury yacht, complete with nubile young things handing out free beer, ferried an international press corps to the reef site. Even the tug boat company had its own public relations firm handing out press releases.

The *Mercedes* has created a dive industry in Ft. Lauderdale all by herself. There are other wrecks in Broward, but it is the *Mercedes* people want to see. "On any given weekend day, I've counted 18 boats at once on the *Mercedes*. That's 10 divers," says dive instructor Johnny Weinstein.

With this kind of hype, we had to take a look. Luckily we could do it on a weekday, and so had the wreck practically to ourselves.

Like the *Orion*, the *Mercedes* emerged slowly from the green thickness, becoming visible in pieces. After only a matter of weeks, the algae was indeed thick. But

the true excitement was the fish.

We crawled down the anchor line and immediately came face to face with a dozen four-foot barracudas. They eyed us and flashed by, turning for a second pass. They were clearly impatient for us to move on so they could get on with business.

Business was chasing after the thousands of minnows and pilchards hovering in clouds around the wreck. At first, the clouds looked like a billowing sand storm. Then we realized each grain had a tiny eye.

Ducking under a railing, we floated weightless along a deck, emerging at the bow where the almost microscopic minnows had been replaced with flat, silver pilchards. They moved in perfectly choreographed waves, crinkling in unison like a wall of Christmas tinsel.

We left them there, billowing nervously while the dozen barracuda hovered nearby. The *Mercedes* is definitely worth a dive.

These days, derelict ships are being sunk almost every month. After the *Mercedes* came the *Rebel*, which also went down off Ft. Lauderdale but with far less fanfare.

Again, members of South Florida Divers Club spent nights and weekends scraping scum off the ship. Again, there were sponsors but though only a third of the *Mercedes* collection. The crucial help came quietly from a local attorney, a diving and fishing fan, who insists his name remain undisclosed. He bought the freighter turned pot boat turned derelict for \$17,500 and just gave it, no strings attached, to the county. In return, the county let him christen it. He named it after his dog.

What ships like the *Rebel*, *Mercedes* and *Orion* have done for southeast Florida is turn it, overnight, into a true diving destination. For years, south Florida has been a jumpoff point for divers going elsewhere. Now people have a reason to come and stay.

Wreck diving is more important for the experienced dive crowd. Granted, the hordes of tropical fish in the Keys are fascinating, but flopping around in 30 feet of water can grow old after a while.

Most of Florida's new wrecks lie at 100 feet and more. There are currents to contend with and decompression tables, but the fascination of crawling through intact, enclosed wrecks is exciting.

So now, there is a real thrill for divers just off Florida, especially for experienced divers who love poking around dark corners. Watching a silver river of grunts flow up the sides of a hull, floating through an engine room or crawling across a cargo hold covered with spiny oysters are not experiences you're soon to forget.

S

## WHY DIVE GRAND BAHAMA? Reason No. 6

**"At UNEXSO, the boats and equipment are reliable. And our scheduled dive trips go out—even if there's only one diver on the boat!"**

GINA  
CHENOWETH  
UNEXSO Instructor



Compare facilities and prices. Then you'll know why the famous Underwater Explorers Society is famous.

Write for our Dive Destination Checklist and color brochure, and we'll send you a certificate for a FREE DIVE in the Bahamas! One certificate per customer, please.

**UNDERWATER  
EXPLORERS  
SOCIETY**  
  
**UNEXSO**  
P.O. Box F2433 Dept. K  
Freeport, Grand Bahama (809) 373-1244

## DIVE THE FABULOUS FLORIDA KEYS

WITH

**HALL'S®  
DIVING  
CENTER  
& CAREER INSTITUTE**



### "A COMPLETE VACATION RESORT"

- Over 40 miles of reef traveled weekly.
- Fantastic corals & tropical marine life.
- CAVES • LEDGES • DROP OFFS.

**BEGINNER thru INSTRUCTOR  
COURSES START EVERYDAY  
SUPER DIVE PACKAGES**

1688 OVERSEAS HWY., BLDG. 6  
MARATHON, FL 33050  
(305) 743-5929

[GROUP RATES ON REQUEST]





# SCUBAPRO

## authorized dealers



Most shops listed offer sales, service, rentals, instructions and tank refills. Please call for specific information.

### ALABAMA

**Capitol Dive Center**  
5163 Atlanta Hwy.  
Montgomery 36109  
(205) 279-8002  
Tuesday-Friday: 10 to 6  
Monday: 12 to 6  
Saturday: 10 to 5  
**Grant Atzbell's Outdoor World**  
1525 Broadway St.  
Sheffield 35660  
(205) 383-2930  
Monday-Saturday: 9 to 5  
**Skinny's Scuba Shack**  
1215 Center Point Rd.  
Birmingham 35216  
(205) 653-0000  
Monday-Friday: 10 to 6  
Saturday: 9 to 4  
Closed Wed. & Sun.

**Tropical Outfitters Watersports, Inc.**  
Route 1, Box 581 - Hwy. 99  
Gulf Shores 36542  
(205) 968-2339  
Daily: 9 to 8

### ALASKA

**Alaska Mining & Diving Supply Inc.**  
3222 Commercial Dr.  
Anchorage 99501  
(907) 271-1741  
Monday-Saturday: 9 to 6

**Denali Diving Specialties**  
Ml. 42 Parks Hwy.  
Wasilla 99567  
(907) 376-3483

Monday-Saturday: 10 to 6  
Closed Tues. & Sun.

**Don's Dive Shop**

106 Forest Dr.  
Kenai 99611  
(907) 283-5109  
Monday-Saturday: 10 to 6

**S.E. Diving & Sports**

203 Lincoln St.  
Sitka 99835  
(907) 747-8279

**Mac's Dive Shop**

2214 Muir Street  
Juneau 99801  
(907) 789-5115  
Monday-Friday: 10 to 6  
Saturday: 10 to 6  
Sunday: 12 to 5

### ARIZONA

**Aqua Sports**  
4230 E. Indian School Rd.  
Phoenix 85018  
(602) 955-4120

Monday-Friday: 9 to 6:30  
Saturday: 9 to 5:30

**Desert Divers of Tucson**

3550 N. 1st Ave. Ste. 140  
(602) 887-2822  
Monday-Friday: 10 to 6  
Saturday: 10 to 3

**Tucson School of Diving**

3575 E. Speedway  
Tucson 85716  
(602) 795-1440  
Tuesday-Saturday: 10 to 7

Illustration by Nick Farn

## ARKANSAS

**Rick's Pro Dive 'N' Ski Shop Inc.**  
2323 N. Poplar  
N. Little Rock 72114  
(501) 753-6004  
Monday-Friday: 10 to 8  
Saturday: 10 to 6  
**Sports-Scuba Hut**  
2806 W. Sunset  
Springdale, 72764  
(501) 751-0636  
Monday-Saturday: 9 to 6

## CALIFORNIA

**Aloha Diving School**  
2910 W. Magnolia Ave.  
Burbank 91505  
(818) 846-1320  
Monday-Saturday: 12 to 7  
**Aloha Diving School**  
7620 Tampa Ave.  
Reseda 91335  
(818) 343-6343  
Monday-Saturday: 12 to 7

## American Institute of Diving

1901 Pacific Coast Hwy.  
Lomita 90717  
(213) 326-6663  
Monday-Friday: 10 to 7  
Sat. & Sun.: 9 to 6  
**Aqua Ventures**  
2172 Pickwick Dr.  
Camarillo 93010  
(805) 484-9534  
Monday-Friday: 10:30 to 6  
Saturday: 9:30 to 7

**Aqua Ventures**  
1001 S. Harbor Blvd.  
Oceanside 92030  
(605) 985-8861  
Monday-Thursday: 10:30 to 6  
Fri. & Sat.: 9 to 6:30

**Aqua-Gear**  
1234 9th Ave.  
San Francisco 94122  
(415) 564-2825  
Monday-Saturday: 10 to 6  
**Aquarius Dive Shop**  
2240 Del Monte Ave.  
Montreux 93940  
(408) 375-1933  
Monday-Friday: 9 to 6  
Sat. & Sun.: 7 to 6

**Auburn Ski Hut**  
585 High St.  
Auburn 96003  
(916) 885-2232  
Daily: 9 to 6

**Black Bart's Aquatics**  
34145 Coast Hwy.  
Dana Point 92629  
(714) 496-5891  
Monday-Saturday: 8 to 6

**Black Bart's Aquatics**  
24882 Muirlands  
El Toro 92630  
(714) 855-2323  
Monday-Friday: 10 to 8  
Sat. & Sun.: 8 to 6

**Bob's Dive Shop**  
4374 N. Blackstone Ave.  
Fresno 93726  
(209) 225-0156  
Monday-Friday: 10 to 7  
Saturday: 9 to 6  
Sunday (Summer): 9 to 6

**Cal Aquatics**  
22725 Ventura Blvd.  
Woodland Hills 91364  
(818) 346-4759  
Monday-Friday: 9:30 to 9  
Saturday: 9:30 to 6:30

**Catalina Divers Supply**  
On The Pier  
Avalon 90704  
(213) 510-0330

**Catalina Scuba**  
P.O. Box 1636, Catherine Hotel  
Avalon 90704  
(213) 510-0077  
Daily: 7 to 9

**Cole-Riv-Vai Divers & Supply**  
1920 Rio Vista  
Needles 92363  
(714) 326-3233  
**D.D.B. Dive Shop**  
P.O. Box 5429  
Rancho Dominguez 90221  
Monday-Friday: 10 to 9

**The Dive Shop**  
312 N. Harbor Blvd.  
Santa Ana 92703  
(714) 554-6870  
Monday-Thursday: 10 to 6  
Friday: 10 to 7  
Sat. & Sun.: 10 to 6

**Dive West**  
115 W. Main St.  
Santa Maria 93454  
(805) 926-3278  
Monday-Saturday: 10 to 6  
Sunday: 12 to 6

**Divers Corner**  
11200 Old River School Rd.  
Downey 90241  
(213) 927-1417  
Mon., Wed., Fri., & Sat.: 9 to 6  
Tues. & Thurs.: 9 to 9  
Sunday: 12 to 5

**Divers Den**  
22 Anacapa St.  
Santa Barbara 93101  
(805) 963-8977  
Saturday-Thursday: 8:30 to 5:30  
Friday: 8:30 to 7

**Divers Supply of Santa Barbara County**  
554 Hollister Ave.  
Goleta 93117  
(805) 964-0180  
Monday-Friday: 10 to 6  
Saturday: 10 to 5:30  
Sunday: 9 to 6

**Divers West**  
2695 "A" E. Foothill Blvd.  
Pasadena 91107  
(818) 796-4287  
Tuesday-Friday: 10 to 7  
Saturday: 9 to 6

**The Diving Locker**  
1020 Grand Ave.  
San Diego 92109  
(619) 272-1120  
Monday-Friday: 9 to 7  
Sat. & Sun.: 8 to 5

**The Diving Locker**  
348 E. Grand Ave.  
Escondido 92025  
(619) 746-8980  
Monday-Friday: 10 to 7  
Saturday: 9 to 5

**The Diving Locker**  
405 N. Hwy. 101  
Solana Beach 92075  
(619) 755-8822  
Monday: 10 to 6  
Tuesday-Friday: 9 to 8  
Sat. & Sun.: 8 to 5

**The Diving Locker**  
4619 Mission Gorge Pl.  
San Diego 92106  
(619) 286-8800  
Monday-Friday: 10 to 7  
Saturday: 8 to 5  
Sunday: 8 to 12

**Far West Marine Center**  
2941 Willow Lane  
Thousand Oaks 91361  
(805) 495-3600  
Monday-Friday: 9 to 6  
Saturday: 9 to 5

**Far West Marine Center**  
Simi Valley 93065  
**Hornell's Dive Shop**  
1426 Eureka Way  
Redding, 96001  
(916) 241-1571  
Monday-Saturday: 8 to 6

**Hydro Space Dive Shop & Scuba Schools**  
4345 Sonoma Blvd.  
Vallejo 94590  
(707) 554-8957  
Tues.-Sat.: 10 to 8  
Sunday: 9 to 5

**Innerspace Divers**  
1305 N. Chester  
Bakersfield 93308  
(805) 399-1425  
Monday-Friday: 10 to 6  
Saturday: 10 to 3

**124 Marine & Sporting Goods**  
124 Catalina Ave.  
Avalon 90704  
(213) 510-0238  
Daily: 9 to 4

**Malibu Divers**  
21231 Pacific Coast Hwy.  
Malibu 90265  
(213) 466-2396  
Monday-Friday: 10 to 6  
Sat. & Sun.: 8 to 6

**Martin Skin Diving**  
3765 Redwood Hwy.  
San Rafael 94903  
(415) 479-4332  
Monday-Friday: 10 to 7  
Sat. & Sun.: 9 to 5

**Marina Del Rey Divers**  
2539 Lincoln Blvd.  
Marina Del Rey 90291  
(213) 827-1131 Cal only  
1-800-227-9042 Others  
Friday, Saturday: 10 to 7:30  
Sunday: 10 to 4:00

**Napa Gun & Dive Exchange**  
950 Randolph St.  
Napa 94559  
(707) 255-3900  
Monday-Saturday: 9 to 6

**Openwater Habitat, Inc.**  
411 South Main Street  
Orange 92668  
(714) 633-7283/CA 1-800-334-6457  
Monday-Thursday: 10 to 7  
Friday: 10 to 8  
Saturday: 9 to 7

**Outrigger Dive Shop**  
2110 Winchester Blvd.  
Campbell 95008  
(408) 324-8411  
Monday-Friday: 10 to 7  
Saturday: 9 to 5:30

**Pacific Sporting Goods**  
11 39th Pl.  
Belmont Shore 90813  
(213) 434-1604  
Monday-Thursday: 10 to 6:30  
Friday: 10 to 7, Sat.: 9 to 6  
Sunday: 9 to 5

**Pacific Sporting Goods**  
1719 S. Pacific Ave.  
San Pedro 90731  
(213) 833-2422  
Monday-Thursday: 10 to 6:30  
Friday: 10 to 7, Sat.: 10 to 6  
Sunday: 9 to 5

**Peninsula Diving Center**  
1015 W. El Camino Real  
Mountain View 94040  
(415) 965-2241  
Tuesday-Friday: 10:30 to 7  
Saturday: 10 to 5

**The Pinnacles Dive Center**  
875 Grant Ave.  
Novato 94947  
(415) 897-8962  
Monday-Friday: 10 to 7  
Sat. & Sun.: 8 to 4

**The Pinnacles Dive Center**  
2100 Army Dr.  
Santa Rosa 95401  
(707) 542-3100  
Monday-Friday: 10 to 7  
Sat. & Sun.: 8 to 4

**San Diego Divers Supply**  
4004 Sports Arena Blvd.  
San Diego 92110  
(619) 224-3439  
Monday-Thursday: 9 to 7  
Friday: 9 to 9  
Sat. & Sun.: 8 to 6

**Scuba Dive Shop**  
7128 Reseda Blvd.  
Reseda 91335  
(818) 861-4545  
Monday-Saturday: 10 to 7

**Scuba Haus**  
2501 Wilshire Blvd.  
Santa Monica 90403  
(213) 829-2916  
Monday-Thursday: 10 to 6  
Friday: 10 to 7  
Sat.: 10 to 6, Sun.: 12 to 5

**Scuba Toys Too**  
1640 W. Lincoln  
Anaheim 92801  
(714) 956-5540  
Monday-Thursday: 12 to 7  
Friday: 12 to 8  
Sat. & Sun.: 8 to 6

**Scuba Toys**  
9547 Valley View Ave.  
Cypress 95030  
(714) 527-0340  
Monday-Thursday: 10 to 7  
Friday: 10 to 9  
Sat.: 10 to 7, Sun.: 10 to 6

**ScubaVentures**  
2222 E. Cliff Dr.  
Santa Cruz 95062  
(408) 476-5201  
Monday-Thursday: 9 to 5  
Saturday & Sunday: 8 to 6  
Friday: 9 to 6

**Sea D Sea**  
1911 S. Catalina Ave.  
Redondo Beach 90277  
(213) 373-6355  
Monday-Friday: 10 to 7  
Sat. & Sun.: 8 to 6

**Southern Calif. Diving Center**  
1121 S. Glendora Ave.  
West Covina 91790  
(818) 338-8883  
Monday-Saturday: 9 to 7  
Sport Diving West, Inc.  
11501 Whittier Blvd.  
Whittier 90601  
(213) 692-7373  
Monday-Friday: 10 to 8  
Saturday: 10 to 6

**Sports Cove**  
895 Arroyo Dr.  
Vacaville 95588  
(707) 448-9454  
Monday-Friday: 10 to 8  
Sat.: 10 to 6, Sun.: 12 to 5

**The Stalker**  
8065 Greenback Ln.  
Citrus Heights 95610  
(916) 481-8286  
Monday-Friday: 10 to 9  
Saturday: 10 to 6  
Sunday: 12 to 5

**St. Thomas**  
1432 Clough Avenue  
Fresno 93726  
(209) 297-7006  
Monday-Saturday: 10 to 6

**Stan's Skindiving**  
554 S. Bascom St.  
San Jose 95128  
(408) 294-7177  
Monday-Thursday: 10 to 6:30  
Friday: 10 to 8  
Saturday: 9 to 5

**Tri Valley Scuba School, Inc.**  
21310 San Ramon Valley Blvd.  
San Ramon 94583  
(415) 829-9040  
Monday-Friday: 11 to 6  
Saturday: 10 to 4

**Ukiah Skin and Center**  
1178 N. State St.  
Ukiah 95462  
(707) 462-5396  
Monday-Friday: 10 to 5:30  
Saturday: 7 to 5  
Sunday (April-Oct.): 6 to 3

**Undersea Showers**  
1335 West Foothill Blvd.  
Upland 91786  
(714) 946-2266  
Monday-Saturday: 10 to 7

**Underwater Schools of America, Inc.**  
306 Wisconsin Ave.  
Oceanside 92054  
(619) 722-7826  
Daily: 9 to 6

**Underwater School of America**  
27601 Forbes Road  
Laguna Niguel 92677  
(714) 831-6650  
Daily: 9 to 6

## Ventura County Skin & Scuba

1559 Spinnaker, Suite 106  
Ventura 93001  
(805) 656-0167  
Monday-Saturday: 9:30 to 6  
Sunday: 10 to 5  
**Water Pro Sports Shop**  
280 Higuera St.  
San Luis Obispo 93401  
(805) 543-3483  
Monday-Friday: 10 to 5  
Saturday: 8 to 5  
**Water Sports Unlimited**  
732 North H Street  
Lompoc 93436  
(805) 736-1800  
Monday-Saturday: 10 to 6

## COLORADO

**Beaver Divers**  
110 East Beaver Creek Blvd.  
Avon 81620  
(303) 476-5397  
Monday-Friday: 10-2, 3:30-8  
**Blue Mesa Scuba Center**  
500 N. Townsend Ave.  
Montrose 81401  
(303) 249-9609  
Monday-Saturday: 9 to 5:30  
**Denver Divers Supply**  
557 Milwaukee  
Denver 80206  
(303) 399-2877  
Monday-Friday: 10 to 7  
Saturday: 10 to 6  
**Diver's Reef**  
3014 N. Nevada  
Colorado Springs 80907  
(303) 634-3366  
Monday-Saturday: 10 to 6  
**Rocky Mountain Diving & Sailboard Center**  
1737 15th St.  
Boulder 80302  
(303) 449-8606  
Monday-Friday: 10:30 to 6:30  
Saturday: 10 to 5

## CONNECTICUT

**Swim & Dive Center (Multi-Tech)**  
190 Flinders Rd.  
Wentick 06357  
(203) 739-9596  
**DISTRICT OF COLUMBIA**  
**National Diving Center**  
4932 Wisconsin Ave. N.W.  
Washington D.C. 20016  
(202) 363-6123  
Monday-Friday: 9 to 8  
Saturday: 9 to 5  
Sunday: 10 a.m. to 4 p.m. (5:30-10:30)  
**FLORIDA**  
**ABC Sports Inc.**  
1915 Linhart  
Ft. Myers 33901  
(813) 334-4616  
Monday-Friday: 10 to 5:30  
Saturday: 10 to 3  
**Adventure Diving, Inc.**  
3127 S. Ridgewood Ave.  
South Daytona 32019  
(904) 788-8050  
Monday-Saturday: 9 to 6  
**Adventure Scuba**  
150 N. U.S. Hwy. 1  
Tampa 33606  
(813) 334-4616  
Monday-Friday: 10 to 5:30  
Saturday: 10 to 3  
**Amel Dive**  
7166 Beracasa Way  
Boca Raton 33433  
(305) 395-4407  
Daily: 9 to 7  
**American Diving Headquarters Inc.**  
Route 1, Box 2748  
Key Largo 33037  
(305) 451-0037  
Daily: 7:30 to 6  
**Aqua Den Scuba**  
9469 S.E. Hwy. 441  
Ocala 32671  
(904) 245-5567  
Closed Tuesday  
Other Days: 10 to 7

## Aquanauts South

915 S.W. 67th Ave.  
Miami 33174  
(305) 262-9295  
Monday-Saturday: 9 to 7  
**AquaShop**  
505 Northlake Blvd.  
North Palm Beach 33409  
(305) 848-9042  
Daily: 8 to 6  
**Aquatic Center Inc.**  
2125 S.W. 34th St.  
Gainesville 32608  
(904) 377-0106  
Monday-Saturday: 10 to 7  
**Buddy's Dive Shop**  
M.M. 80 Overseas Hwy.  
Islamorada 33036  
(305) 664-4704  
Daily: 8 to 6  
**C & G Sporting Goods Inc.**  
137 Harrison Ave.  
Panama City 32401  
(904) 769-2317  
Monday-Saturday: 8:30 to 5:30  
**Coastal Sport & Diving**  
2407 10th Ave. North  
Lake Worth 33460  
(305) 965-0524  
Monday-Saturday: 10 to 7  
Sunday: 7:30 to 2  
**D & S Diving**  
225 E. Brandon Blvd.  
Brandon 33511  
(813) 681-1981  
Mon., Wed., Fri. & Sat.: 10 to 6  
Tues. & Thurs.: 10 to 9  
**Dive Shop II**  
Sea Mist Marina  
703 Casa Loma Hwy.  
Boynton Beach 33435  
(305) 278-9111, 734-5566  
Monday-Friday: 9 to 7  
Saturday & Sunday: 8 to 5  
**Franks Dive Shop**  
301 E. Blue Heron Blvd.  
Riverside Beach 33404  
(305) 848-7532  
Monday-Friday: 8 to 5:30  
Saturday & Sunday: 7 to 5:30  
**Hal Watts Scuba Plus**  
2215 E. Colonial Dr.  
Orlando 32803  
(305) 896-4541  
Monday-Friday: 1 to 6:30  
Saturday: 9 to 6  
**Hall's Dive Shop**  
1888 Overseas Hwy.  
Marathon 33050  
(305) 743-5929  
Daily: 9 to 6  
**Iland Dive, Inc.**  
241 N. Collier Blvd.  
Marco Island 33937  
(813) 394-9777  
Monday-Saturday: 9 to 6  
**Jensen Beach Divers**  
1951 Northeast Drive Hwy.  
Jensen Beach 33457  
(305) 334-7333  
Daily: 9 to 6  
**Key West Pro Dive Shop, Inc.**  
1605 N. Roosevelt Blvd.  
Key West 33040  
(305) 296-3823  
Monday-Saturday: 9 to 6  
**Key West Pro Dive Shop Inc.**  
2259 Bee Ridge Rd.  
Sarasota 33582  
(813) 924-3483  
Monday-Thursday: 10 to 6  
Friday: 10 to 9  
Saturday: 9 to 6  
**Panama City Dive Center**  
4823 Thomas Drive  
Panama City  
(904) 235-3390  
Daily: 9 to 6  
**Pro Dive**  
2507 N. Ocean Blvd.  
Pompano Beach 33062  
(305) 942-3000  
Daily: 8 to 8

## Professional Diving Schools of Florida

8415 Mar Yachting Center  
801 Seabreeze Ave.  
Ft. Lauderdale 33316  
(305) 761-3413 Daily: 9 to 5  
**Scuba Shop**  
230 N. Eglin Parkway  
Fort Walton Beach 32548  
(904) 863-1341  
Sunday-Friday: 9 to 5  
Saturday: 8 to 8  
**Scuba-Ski Inc.**  
118 9th St., South  
Naples 33940  
(813) 262-7388  
Monday-Saturday: 10 to 6  
**Sea Center Dive Shop**  
M.M. 29 1/2 Rte. U.S. 1  
Big Pine Key 33043  
(305) 872-2219  
Daily: 8 to 6  
**Skippers Diving Center**  
408 E. Wright St.  
Pensacola 32501  
(904) 434-0827  
Summer/Daily: 9 to 6  
Winter/Closed Sunday  
**Submariner**  
940 N.E. 27th Ave.  
Fort Lauderdale 33304  
(305) 522-7722  
Monday-Friday: 10 to 6  
Saturday: 9 to 5  
**Tackle Shack**  
7801 66th St. North  
Pineles Park 33565  
(813) 546-5080  
Monday-Saturday: 10 to 7  
**Vortex Springs**  
Route 2, Box 18A  
Ponce de Leon 32455  
(904) 836-4979  
Monday-Thursday: 7:30 to 5  
Friday-Sunday: 7 to 7  
**GEORGIA**

**Adventures For All Seasons**  
1430 Baxter Street  
Athens 30606  
(404) 546-5877  
Monday-Friday: 10 to 6  
Saturday: 10 to 4  
**Dive Sales & Salvage**  
1925 Piedmont Circle  
Atlanta 30324  
(404) 872-6449  
Monday-Friday: 10 to 6  
Saturday: 10 to 2  
**Garrard Pro Divers**  
2555 Deak Road  
Maretta 30067  
(404) 984-0382  
Monday-Thursday: 10 to 7:30  
Friday & Saturday: 10 to 6  
**Planet Ocean Scuba Center**  
Windsor Village Shopping Center  
Columbus 31909  
(404) 563-8675  
Monday-Friday: 10 to 6:30  
Saturday: 10 to 5  
**HAWAII**

**Aloha Dive Shop**  
Kolo Marina Shopping Center  
Honolulu, Oahu 96825  
(808) 395-8882, 5922  
Daily: 8 to 5:30  
**Aquatics Kaula Ltd.**  
4-733 Kuhio Hwy.  
Kapaa, Kauai 96746  
(808) 822-9213  
Monday-Saturday: 8:30 to 5:30  
Sunday: 9 to 5  
**Central Pacific Divers**  
780 Front St.  
Lahaina, Maui 96761  
(808) 661-4661  
Daily: 7 to 9  
**Fathom Dive Prof. Divers**  
PO Box 907  
Koloa, Kauai 96756  
(808) 742-8991  
Daily: 8:30 to 5:30  
**Hawaiian Divers**  
4510 Salt Lake Blvd., Suite D7  
Honolulu, Oahu 96819  
(808) 847-8969  
Monday-Friday: 9 to 5  
Sat., 8 to 6 Sun., 8 to 4  
**Kona Coast Skin Diver Ltd.**  
75-5614 Palani Road  
Kailua Kona 96740  
(808) 329-8802  
Daily including holidays: 7 to 6  
**Kona Reef Divers**  
PO Box 1409  
Kamuela 96743  
(808) 885-4841, 325-5555  
Daily: 8 to 6  
**Lahaina Divers, Inc.**  
162 Lahainaluna Road  
Lahaina, Maui 96761  
(808) 661-9611  
Daily: 8 to 9:30  
**Leeward Dive Center**  
85-879 Farrington Hwy.  
Wailea, Oahu 96792  
(808) 666-3414  
Daily: 8 to 5  
**Maul Dive Shop**  
PO Box 1018 Aiea Pl.  
Kihei, Maui 96753  
(808) 879-3388  
Monday-Friday: 8 to 9 p.m.  
Sat. & Sun.: 8 to 8  
**Oahu School of Diving Pro Dive Shop**  
25 S. Kam Hwy.  
Wahiawa, Oahu 96786  
(808) 622-2283  
Monday-Friday: 10 to 6  
Sat. & Sun.: 8 to 4  
**Ocean Activities Center**  
3750 Wailea Alanui Dr.  
Wailea, Maui 96753  
(808) 879-4485  
Daily: 9 to 8  
**Rainbow Divers**  
1652 Wilkina Dr.  
Wahiawa, Oahu 96786  
(808) 622-4532  
Monday-Friday: 9 to 6  
Sat. & Sun.: 8 to 6  
Closed Wednesday  
**Scuba Schools of Maui**  
1000 Linahana Pl., Suite A  
Lahaina, Maui 96761  
(808) 661-8036  
Daily: 8:30 to 5  
**Sea Paradise**  
PO Box 5635  
Kailua-Kona 96740  
(808) 322-2500  
Daily: 7:30 to 5:30  
**Sea Sage**  
4-1733 Kuhio Hwy.  
Kapaa, Kauai 96746  
(808) 822-3841  
Daily including holidays: 8:30 to 5:30  
**Ocean Adventures**  
408 Kam Hwy.  
Pearl City, Oahu 96782  
(808) 487-9060  
Monday-Sunday: 8 to 6  
Tuesday: 8 to 4  
Closed Wednesday  
**South Seas Aquatics**  
1050 Ala Moana Blvd.  
Honolulu 96734  
(808) 538-3854  
Monday-Friday: 10 to 9  
Saturday: 10 to 5  
Sunday: 10 to 4

**Waikiki Diving, Inc.**  
420 Nahu St.  
Honolulu, Oahu 96815  
(808) 922-1188, 7185  
Monday-Friday: 8 to 6  
Sat. & Sun.: 8 to 5

## IDAHO

**The Scuba Diving Co.**  
219 W. 37th St.  
Boise 83714  
(208) 343-4470  
Daily: 9:30 to 6:30

## ILLINOIS

**Anchor International Inc.**  
315 W. Ogden Ave.  
Westmont 60559  
(312) 971-1080  
Monday-Friday: 12 to 9  
Saturday: 10 to 5, Sunday: 10 to 3

**Anchor International**  
1790 Algonquin Rd.  
Arlington Heights 60005  
(312) 253-1960  
Monday, Tuesday, Thursday, Friday: 5 to 9

## Aqua Center Inc.

43 E. Downer  
Aurora 60506  
(312) 896-3596  
Monday-Friday: 7 to 9 p.m.  
Saturday: 12 to 5  
Closed Wed. & Sun.

## Aquaventure Diving School

1665 Oakton St.  
Des Plaines 60018  
(312) 297-4144  
Monday-Friday: 12 to 8  
Saturday: 12 to 6  
Closed Tues. & Sun.

## Blue Hole Dive Shop

4817 W. Farmington Rd.  
Peoria 61604  
(309) 676-1852  
Mon., Wed. & Fri.: 4 to 8  
Saturday: 9 to 5  
Sunday: (May 1-Sept. 15) 10 to 12

## The Scuba Shop Inc.

800 Roosevelt Rd. Bldg. D-104  
Gen. Elynn 60137  
(312) 858-4485

## IOWA

**Dubuque Yacht Basin**  
1630 E. 16th St.  
Dubuque 52001  
(319) 558-7708  
Monday-Friday: 10 to 8  
Saturday: 10 to 3

**Iowa State Skin Diving Schools, Inc.**  
West University Plaza  
7500 W. University Ave., Suite C  
Des Moines 50311  
(515) 255-0001  
Monday-Friday: 10 to 7  
Saturday: 10 to 6

## INDIANA

**Divers Supply Company, Inc.**  
3301 N. Illinois St.  
Indianapolis 46208  
(317) 323-5355  
Mon., Wed. & Fri.: 9 to 7:30  
Tues. & Thurs.: 9 to 5:30  
Saturday: 9 to 5

## Divers World

1271 E. Morgan Ave.  
Evansville 47711  
(812) 423-2738  
Monday-Friday: 10 to 6  
Saturday: 8 to 5

## Midwest Scuba Center, Inc.

9508 Ross Lane  
Indianapolis 46268  
(317) 872-2522  
Monday-Friday: 10 to 7  
Saturday: 9 to 5

## Pro Dive Shop

3203 Covington Road  
Ft. Wayne 46804  
(210) 432-7745

## Underwater Adventures, Inc.

1509 Goshen Road  
Fort Wayne 46806  
(219) 464-1456  
Monday-Friday: 11 to 7  
Saturday: 9 to 5

## KANSAS

### Adventure Sports

East Side Britany Shopping Center  
2120 N. Woodawn #30  
Wichita 67208  
(316) 689-8052  
Daily: 10 to 6

### The Dive Shop

3805 W. 35th St.  
Lawrence 66044  
(913) 381-4400  
Daily: 10 to 7  
Sunflower 11  
208 West 9 Street  
Ellinwood 67526  
(316) 564-2088  
Monday-Saturday: 2 to 7

## KENTUCKY

### Divers, Inc.

4607 Dixie Hwy.  
Louisville 40216  
(502) 448-7433  
Monday-Friday: 10 to 7  
Saturday: 10 to 5

**Lexington Dive Shop**  
819 Euclid Ave.  
Lexington 40502  
(606) 266-4703  
(502) 458-8427  
Monday-Friday: 11 to 7  
Saturday: 11 to 5

**Louisville Dive Shop**  
2478 Bardstown Rd.  
Louisville 40205  
(502) 458-8427  
Monday-Friday: 11 to 7  
Saturday: 11 to 5

## LOUISIANA

### Adventure Sports Inc.

1817 Texas Ave.  
Shreveport 71103  
(318) 425-3870  
Monday-Saturday: 10:30 to 8:30

**Bayou Ventures Inc.**  
809 Brashear Ave.  
Morgan City 70381  
(504) 385-3483  
Monday-Friday: 9 to 5  
Saturday: 9 to 12

### Oceans 1 School of Diving

1300 W. 21st Ave.  
Covington 70433  
(504) 962-9647  
Monday-Saturday: 10 to 6  
Sea Horse Diving Academy  
5400 Crowder Blvd., Unit "E"  
New Orleans 70127  
(504) 246-6523  
Monday-Friday: 11 to 7  
Saturday: 10 to 6

### Seven Seas

633 Oak Villa Blvd.  
Baton Rouge 70815  
(504) 928-1819  
Monday-Saturday: 9:30 to 5:30

### Vineyards Dive Shop

1400 W. Esplanade Ave. Unit E  
Kenner 70065  
(504) 468-3483  
Monday-Friday: 10 to 7  
Saturday: 10 to 6

## MAINE

### Aqua Dive Academy

1183 Congress St.  
Portland 04101  
(207) 772-4200  
Monday-Saturday: 10 to 5

**Skin Diver's Paradise**  
RFD #3, Turner Rd., Box 817  
Auburn 04210  
(207) 782-7709  
Monday-Friday: 2 to 9  
Saturday: 7 to 6

## MARYLAND

### Divers Den Inc.

8105 Hartford Rd.  
Baltimore 21234  
(301) 668-6866  
Mon., Tues., Thurs. & Fri.: 9:30 to 9  
Wed. & Sat.: 9:30 to 5

### Divers World

923 Silt Ave.  
Silver Springs 20910  
(301) 587-7784  
Monday-Friday: 10 to 9  
Saturday & Sunday: 9 to 5

### The Scuba Hut, Inc.

139 Delaware Avenue  
Glen Burnie 21061  
(301) 761-4520  
Mon., Wed. & Fri.: 10 to 8  
Tuesday & Saturday: 10 to 6

### Tide Water Aquatics

1315 Forest Dr.  
Annapolis 21403  
(301) 268-1992  
Monday-Friday: 10:30 to 7:30  
Saturday: 10:30 to 5:30

## MASSACHUSETTS

### Aquarius Diving Center Inc.

3239 Cranberry Hwy.  
Buzards Bay 02532  
(617) 759-DIVE  
Monday-Friday: 10 to 7  
Saturday: 8 to 4

### Aquarius Diving Center, Inc.

1 Herring Run  
East Sandwich 02537  
(617) 889-1927  
Daily

### Lowell Scuba Center

477 Gorham St.  
Lowell 01852  
(617) 453-7574  
Monday-Friday: 11 to 7  
Saturday: 11 to 5:30

### So. Shore Skindivers, Inc.

511 Washington St.  
Quincy 02269  
(617) 477-9800, 773-5452  
Monday-Saturday: 9:30 to 8:30  
Sunday: 9 to 1

### United Divers, Inc.

59 Washington St.  
Somerville 02143  
(617) 666-0410  
Monday-Friday: 10 to 8, Saturday: 9 to 8, Summer/Sunday: 9 to 4

### Whaling City Diving Center

39 Main St.  
Fairhaven 02719  
(617) 992-2662  
(Winter) Monday-Friday: 4:30 to 7:30  
Sat.: 10 to 4, Sun.: 9 to 12  
(Summer) Monday-Friday: 10 to 7:30  
Sat.: 9 to 5, Sun.: 9 to 1

## MISSISSIPPI

### Divers Supply Company

2377 N. Long Lake Rd.  
Fenton 38430  
(313) 629-3483  
Mon., Tues., Thurs. & Fri.: 10 to 8  
Wed. & Sat.: 10 to 6

### Kalamazoo Diving Center

1622 Bloomfield Ave.  
Kalamazoo 49001  
(616) 345-2060  
Monday-Friday: 10 to 7  
Saturday: 10 to 5

### Divers

3380 Washtenaw Avenue  
Ann Arbor 48104  
(313) 971-7771  
Monday-Friday: 10 to 6  
Saturday: 10 to 5  
Closed Tuesday & Sunday

**Recreational Diving Systems**  
4424 N. Woodward  
Royal Oak 48072  
(313) 549-0303  
Monday-Friday: 10 to 7  
Saturday: 10 to 5

## Scuba North, Inc.

13258 W. Bayshore Dr.  
Traverse City 49684  
(616) 947-2520  
Monday-Thursday: 9 to 8  
Friday & Saturday: 9 to 8  
Sunday: 10 to 5  
(Winter) Mon-Sat.: 10 to 6

### The Scuba Shack

9982 W. Higgins Lake Dr.  
Higgins Lake 48527  
(517) 821-6477  
(Summer) Monday-Friday: 9 to 5  
Saturday & Sunday: 9 to 8

### Seagulls, Inc.

979 S. Saginaw Road  
Midland 48640  
(517) 835-6391  
Monday-Friday: 10 to 8  
Saturday: 10 to 5

### Skamit Shop

5055 Plainfield N.E.  
Grand Rapids 49505  
(616) 364-8418  
Monday, Wednesday, Friday: 10 to 9  
Tuesday, Thursday, Saturday: 10 to 6

### Tom & Jerry's Skin & Scuba Shop

20318 Van Buren Ave.  
Dearborn Heights 48125  
(313) 278-1124  
Monday-Friday: 11 to 7  
Saturday: 11 to 5

### Tom & Jerry's Scuba & Sport Shop

8655 Dixie  
Fairhaven 48023  
(313) 725-1991  
Daily: 10 to 5

### ZZ Under Water World, Inc.

1806 E. Michigan Avenue  
Lansing 48912  
(517) 485-3894  
Monday-Friday: 10 to 7  
Saturday: 10 to 5

## MINNESOTA

### Central Minnesota Divers

102 E. St. German  
St. Cloud 56301  
(612) 252-7572  
Monday-Friday: 10 to 7  
Saturday: 9 to 5

### Club Scuba East

2280 Maplewood Dr.  
Maplewood 55109  
(612) 484-7252  
Monday-Friday: 10 to 8  
Saturday: 10 to 5  
(Summer) Sunday: 9 to 1

### Club Scuba West

1300 E. Wayzata Blvd.  
Wayzata 55391  
(612) 473-4266  
Monday-Friday: 10 to 8  
Saturday: 10 to 5  
(Summer) Sunday: 9 to 1

## MISSISSIPPI

### Earl's Dive Shop

0812 Pass Rd.  
Gulfport 39501  
(601) 863-2075  
Skippers Diving  
4441 N. State  
Jackson 39201  
(601) 362-6969  
Monday-Friday: 10 to 6  
Saturday: 10 to 5

## MISSOURI

### Divers Village

P.O. Box 329, Lake Road West 20  
Lake Ozark 65049  
(314) 365-3242  
Daily: 9 to 6

### John The Diver

S.R. 1, Box 911  
Branson 65616  
(417) 338-2224  
Daily: 8 to 6  
Nov. through Feb. open by appt.

### Table Rock State Park Marina

S.R. 1, Box 911  
Branson 65616  
(417) 334-3069  
Daily: sunrise to sunset  
Nov. through Feb. open by appt.

**The Dive Shop**  
8135 North Dak  
Kansas City  
(816) 436-5448  
Monday-Friday: 10 to 7  
Saturday: 10 to 5

**MONTANA**  
**Mountain State Divers Supply**  
1525 Central  
Billings 59102  
(406) 252-7583  
Monday-Saturday: 9 to 6

**NEBRASKA**  
**Action Sports 'N' Sail**  
325 N. 72nd Street  
Omaha 68114  
(402) 551-6776  
Mon., Tues., Wed., Thurs.: 10 to 7  
Fri., Sat.: 10 to 7

**Big Mac Scuba & Sail**  
P.O. Box 713  
Lake McCaughy 69101  
(308) 728-2632  
Monday-Friday: 8 to 5  
Saturday & Sunday: 8 to 6

**Fathom Dive**  
13 W. 18th  
Scotts Bluff 69361  
(308) 635-1556  
Daily: 10 to 6

**NEVADA**  
**Desert Divers Supply**  
5720 E. Charleston Blvd.  
Las Vegas 89122  
(702) 438-1000  
Monday-Friday: 8 to 6  
Closed Tuesday  
Saturday & Sunday: 7 to 6

**Scuba Center**  
1250 South Main  
Las Vegas 89101  
(702) 386-0542  
Monday-Saturday: 9 to 7  
Sunday: 10 to 5  
**Sierra Dive Co.**  
104 E. Grove St.  
Reno 89502  
(702) 825-2147  
Mon., Tues., Thurs. & Fri.: 9 to 6  
Wednesday: 9 to 3:30  
Saturday: 10 to 5

**NEW HAMPSHIRE**  
**Atlantic Aqua Sports**  
522 Sagamore Rd.  
Rye 03870  
(603) 436-4443  
Daily: 8 to 5, Closed Tues.

**NEW JERSEY**  
**Cedar Grove Divers Supply**  
482 Pompton Ave., Route 23  
Cedar Grove 07009  
(201) 857-1748  
Tuesday-Friday: 12 to 9  
Saturday: 10 to 5  
Closed Sunday & Monday

**Professional Divers, Inc.**  
70 Hwy. 35  
Neptune City 07753  
(201) 775-8292  
Monday-Friday: 11 to 8  
Saturday: 10 to 6  
Sunday (Summer): 9 to 1

**The Edison S/D Center**  
1659 Hwy. 27  
Edison 08817  
(201) 985-2206  
Monday-Friday: 9 to 9:30  
Saturday: 10 to 8

**Underwater Sports Inc.**  
Route 17 South  
Rochelle Park 07662  
(201) 943-3340  
Monday: 10 to 7  
Tues.-Fri.: 10 to 9  
Sat.: 10 to 6

**Whitehouse Aquatic Center**  
Box 87-C, Rt. 22 West  
Whitehouse Station 08889  
(201) 534-4090  
Monday-Saturday: 10 to 8  
Sunday: 10 to 2

**NEW MEXICO**  
**New Mexico School of Diving**  
4010 E. Main  
Farmington 87401  
(505) 325-2728  
Monday-Saturday: 10 to 6  
**New Mexico Scuba Schools, Inc.**  
11200 Montgomery NE  
Albuquerque 87111  
(505) 282-7990  
Monday-Saturday: 10 to 7

**NEW YORK**  
**Atlantis 2**  
498 Avenue of the Americas  
New York 10011  
(212) 924-7558  
Mon., Thurs., Fri., & Sat.: 10 to 7  
Tuesday & Wednesday: 12 to 7

**Cougar Sports**  
580 Central Park Ave.  
Scarsdale 10583  
(914) 723-2266  
Monday-Wednesday: 10 to 6  
Thursday: 10 to 7, Friday: 10 to 8  
Saturday: 10 to 5

**Danziger Sporting Goods**  
70 Freeport Mall  
Freeport 11520  
(516) 376-4480  
Monday-Saturday: 10 to 5:30

**King County Divers Corp.**  
2417 Avenue U  
Brooklyn 11229  
(212) 648-4232  
Monday-Friday: 2 to 9  
Saturday: 10 to 9

**Niagara Scuba Sports**  
2048 Niagara St.  
Buffalo 14207  
(716) 875-6529  
Mon., Tues., Thurs., & Fri.: 8 to 3:30  
Wed. & Sat.: 9 to 3:30  
Sunday (June through September): 9 to 11:30

**National Aquatic Service, Inc.**  
1732 Ene Blvd. East  
Sarasota 34210  
(941) 579-5544  
Monday-Friday: 9 to 5  
Saturday: 9 to 4

**Suffolk Diving Center**  
58 Lakeside Rd.  
E. Northport 11751  
(516) 261-4388  
Monday-Thursday: 10 to 6  
Fri.: 10 to 8, Sat.: 10 to 6  
Sunday: 10 to 3

**Swim King Dive Shop**  
Rt. 25A  
Rocky Point 11778  
(516) 744-7707  
Monday-Friday: 10 to 7  
Saturday: 8 to 6  
Sunday: 8 to 12

**Waterworld Connections**  
1222 Aerial Highway  
Binghamton 13901  
(607) 772-0106  
Tuesday-Friday: 12 to 6  
Saturday: 10 to 5

**NORTH CAROLINA**  
**Blue Dolphin Dive Shop**  
1006 National Hwy.  
Thomasville 27366  
(919) 475-2516  
Monday-Thursday: 10 to 7  
Friday: 10 to 8  
Saturday: 8 to 6

**Rum Runner Dive Shop Inc.**  
2717 E. 10th St., P.O. Box 3157  
Greenville 27834  
(919) 758-1444  
Monday-Friday: 10 to 5

**Sport Divers Inc.**  
2600 South Blvd.  
Charlotte 28209  
(704) 525-9234  
Monday-Saturday: 9 to 6:30  
**Underwater Unlimited, Inc.**  
2438 Park Road  
Charlotte 28203  
(704) 372-9130  
Monday-Saturday: 10 to 5:30

**OHIO**  
**Buckeye Diving School**  
46 Warrensville Center Rd.  
Bedford 44146  
(216) 439-3577  
Mon., Wed., & Fri.: 12 to 8  
Tues. & Thurs.: 11 to 6  
Saturday: 10 to 5:30

**C & J Scuba**  
8125 North Dixie Dr.  
Dayton 45414  
(513) 980-8900  
Monday-Thursday: 10 to 7  
Friday: 10 to 9

**Dale's Diving Shop Inc.**  
302 Meigs St.  
Sandusky 44870  
(419) 625-4134  
10 to 5:30  
Closed Wednesday and Sunday

**Dive Inc.**  
428 Park Ave. West  
Mansfield 44906  
(419) 524-2484  
Monday-Friday: 12 to 7  
Saturday: 10 to 5

**Divers Paradise**  
2511 N. Reynolds Rd.  
Toledo 43615  
(419) 535-8828  
Monday-Friday: 11 to 7  
Saturday: 10 to 5

**Jaqua's Sporting Goods**  
315 S. Main St.  
Findlay 45840  
(419) 422-2244  
Monday: 8:30 to 9  
Tuesday-Saturday: 8:30 to 5:30

**Ka-Puka-Wai Dive Shop**  
1506 Whipple Ave. N.W.  
Canton 44708  
(216) 478-2511  
Monday & Thursday: 11 to 9  
Tues., Wed., & Fri.: 11 to 6  
Saturday: 10 to 5

**Sub-Aquatics Inc.**  
8855 E. Broad Street  
Reynoldsburg 43068  
(614) 864-1235  
Monday, Tuesday, 10 to 5  
Wednesday-Saturday: 10 to 7

**OKLAHOMA**  
**Chalet Sports**  
2822 Country Club Dr. West  
Oklahoma City 73116  
(405) 840-1616  
Monday-Saturday: 10 to 6  
**Oklahoma School of Scuba**  
1015 1st N.W.  
Ardmore 73401  
(405) 223-1032  
Friday-Wednesday: 10 to 5

**OREGON**  
**Adventure Scuba**  
570 Old Hwy. 62  
Eagle Point 97524  
(503) 826-5317  
1 to 6 or by appt.

**Aquarius Too**  
510 Market St.  
Klamath Falls 97601  
(503) 884-3330  
Monday-Friday: 8 to 5:30

**Beaver Water Sports, Ltd.**  
927 N.W. Circle Blvd.  
Corvallis 97330  
(503) 758-4202  
Monday-Friday: 9 to 6  
Saturday: 9 to 5

**Deep Sea John's**  
P.O. Box 1857  
Newport 97385  
(503) 867-3742  
Daily: 7 to 6

**Northwest Divers Supply**  
852 S. Broadway  
Coos Bay 97402  
(503) 267-3723  
Monday-Saturday: 9 to 6  
Sunday: 9 to 1

**Tri-West Diving School**  
13604 S.E. Powell  
Portland 97236  
(503) 781-5455  
Monday-Friday: 10 to 8  
Saturday: 10 to 5

**PENNSYLVANIA**  
**B & B Marine Specialties**  
Hillsville-Bessmer Rd.  
Hillsville 16132  
(412) 687-9448  
Daily: 9 to 7

**D.J. Hydro Sports**  
2316 Peach St.  
Erie 16502  
(814) 455-5861  
Monday-Friday: 9 to 6:30  
Saturday: 9 to 4:30

**Smoke's Divers Den**  
412 N. Duke St.  
Lancaster 17602  
(717) 393-6333  
Monday-Friday: 9 to 9  
Saturday: 9 to 5

**RHODE ISLAND**  
**Viking Dive Shop**  
124 E. Main Road  
Middletown 02840  
(401) 847-4178  
Sun., Friday: 10 to 6  
Sat.: 10 to 5:30

**SOUTH CAROLINA**  
**Neptune Dive & Ski, Inc.**  
133 Georgia Ave.  
North Augusta 29841  
(803) 279-2797  
Monday-Saturday: 10:30 to 6

**Waterline Diving School & Equipment**  
3202 Fernandina Rd.  
Columbia 29210  
(803) 731-9344  
Monday-Friday: 10:30 to 6:30  
Saturday: 10 to 6

**SOUTH DAKOTA**  
**Danovans Hobby & Scuba Center**  
1908 W. 42nd St.  
Sioux Falls 57105  
(605) 338-6945  
Mon., Wed., Fri., 9 to 9  
Tuesday & Thursday: 9 to 6  
Saturday: 9 to 4:30

**TENNESSEE**  
**Adventure Swim & Scuba**  
1332 Scottsboro Cir.  
Knoxville 37901  
(615) 691-0678  
Closed Sunday

**Diving Adventures**  
3046 Nolensville Rd.  
Nashville 37211  
(615) 331-DIVE(3483)  
Monday-Saturday: 9 to 6  
**Ski-Scuba Center Inc.**  
3521 Sutherland Ave.  
Knoxville ZIP CODE  
(615) 523-9711  
Monday-Saturday: 10 to 6

**TEXAS**  
**Aqua Sphere**  
112 Tremont  
Galveston  
(409) 765-7001  
Monday-Saturday: 9 to 6

**The Aquanaut**  
1009 University Ave.  
Lubbock 79401  
(806) 744-8056  
Tuesday-Saturday: 11 to 5  
**Adventure Dive Shop**  
4099 S. Calder Avenue  
Beaumont 77701  
(409) 832-0254  
Monday-Saturday: 9 to 6

**Blue Water Diving School**  
910 Westheimer  
Houston 7706  
(713) 528-0634  
Call for appt.

**Copeland's**  
4041 S. Padre Island Dr.  
Corpus Christi 78411  
(512) 854-1135  
Monday-Friday: 10 to 7  
Saturday: 9 to 5

**Del Rio Diving**  
P.O. Box 420564  
Hwy. 90 West  
Diablo East Marina  
Del Rio  
(512) 775-2949  
Tuesday-Sunday: 7 to 5



**Diver's Depot-I**  
720 South St.  
Nacogdoches 75961  
(409) 564-9822  
Monday-Saturday: 10 to 6

**Divers Supply Co.**  
325 S. Vine Ave.  
Tyler 75702  
(214) 593-2777  
Monday-Friday: 10 to 5:30  
Saturday: 9 to 2

**Cuff Safari Inc.**  
716 N. Hwy. 288  
Cute 77531  
(409) 265-8401

**Lake LBJ Marine/land**  
(Scuba Unlimited)  
Hwy. 1431 East, P.O. Box 52  
Kingsland 78639  
(915) 388-4724, 6034

Monday-Saturday: 8:30 to 5  
**School of Scuba**  
942 Walnut  
Arlene 78601  
(915) 673-2949

Monday-Saturday: 10 to 6:30  
**Scuba Diving School of Fort Worth**  
3807 Southwest Blvd.  
Fort Worth 76116  
(817) 732-5761

Monday-Saturday: 10 to 6  
**Scuba West**  
5500 Greenville, Suite 901  
Dallas 75206  
(214) 750-6900

Monday-Saturday: 10 to 6  
**Scuba West**  
586 Lincoln Square  
Arlington 76010  
(817) 277-1122

Monday-Saturday: 10 to 6  
**Scuba West**  
14902 Preston Rd., Suite 412  
Dallas 75240  
(214) 960-1300

Monday-Saturday: 10 to 6  
**Scuba West**  
12801 Midway Rd., Suite 401  
Dallas 75234  
(214) 241-4290

Monday-Saturday: 10 to 6  
**Tradewind Diving Academy**  
5215 Sanger  
Waco 76710  
(817) 772-3674

Monday-Saturday: 10 to 6  
Summer: 7 days  
**Trident Diving Equipment**  
2110 West Ave.  
San Antonio 78201  
(512) 734-7442

Monday-Saturday: 10 to 7  
**UTAH**  
**Dive Utah**  
3577 South Main  
Salt Lake City  
(801) 288-3757

Monday-Saturday: 10 to 7  
Saturday: 11 to 4  
**Scuba Utah**  
2356 S. Redwood Rd.  
Salt Lake City 84119  
(801) 972-3235

Monday-Saturday: 10 to 6  
**Scuba Utah North**  
850 Riverdale Rd. A-2  
Ogden 84403  
(801) 394-8842

Monday-Friday: 10 to 6  
Saturday: 10 to 4  
**VERMONT**  
**Chitt Marine**  
67 Main St.  
Burlington 05401  
(802) 862-8383

Daily: 9:30 to 6  
**VIRGINIA**  
**Lynnhaven Dive Center**  
1413 Great Neck Rd.  
Virginia Beach 23454  
(804) 481-7949

Monday-Friday: 9 to 8  
Saturday: 9 to 6  
Sunday: 9 to 4

## WASHINGTON

**Bellingham Dive & Travel**  
2720 W. Maplewood  
Bellingham 98225  
(206) 734-1770

Call for store hours and appts.  
**Capital Skin & Scuba**  
107 E. State St.  
Dlympa 98501  
(206) 357-4128

Monday-Saturday: 9:30 to 6  
**Chelan Divers**  
South Lakeshore Dr.  
Chelan 98816  
(509) 682-4466

Daily: 9 to 5  
**Mike's Diving Center**  
Route 5, Box 916  
Shelton 98584  
(206) 877-9568

Monday-Friday: 10 to 6  
Saturday: 8 to 7  
Sunday: 9 to 6  
Closed Wednesday

**Northwest Divers Inc.**  
4815 N. Pearl  
Tacoma 98407  
(206) 752-3973

Monday-Saturday: 10 to 6  
**Northwest Divers Inc.**  
1113 River Rd.  
Puyallup 98371  
(206) 845-5350

Monday-Saturday: 10 to 6  
**Scuba Center of Spokane**  
N. 3607 Division St.  
Spokane 99207  
(509) 328-4553

Monday-Saturday: 10 to 6  
**Silent World Divers**  
13500 N.E. 20th, Bldg. F, Suite A  
Bellevue 98005  
(206) 747-8942

Monday-Friday: 10 to 7  
Saturday: 9 to 6  
**Sound Dive Center**  
900 Sylvan Way  
Bremerton 98510  
(206) 373-6141

Monday-Friday: 10 to 6  
Saturday: 9 to 6  
Sunday (April to Sept.): 11:30 to 3

**Underwater Sports**  
10545 Aurora Ave., North  
Seattle 98133  
(206) 382-3310

Monday-Saturday: 9 to 9  
Sunday: 9 to 6  
**Whitely Divers Supply**  
608 N.W. & 300 West  
Oak Harbor 98277  
(206) 875-1112

Monday-Friday: 10 to 6  
Saturday & Sunday: 9 to 5  
**WISCONSIN**  
**Bennett Academy of Ski & Scuba**  
6509 W. North Ave.  
Wauwatosa 53213  
(414) 258-6440

Mon., Tues. & Sat.: 10 to 6  
Wed., Thurs. & Fri.: 10 to 9  
**Central Wisconsin Diving Academy**  
8751 Hwy. 13 S.  
Wisconsin Rapids 54494  
(715) 424-3062

Monday-Thursday: 9 to 5  
Friday: 9 to 9  
Saturday: 9 to 5

**WYOMING**  
**Wyoming Scuba Sports**  
1604 D East Lincoln Way  
Cheyenne 82001  
(307) 632-7878

Mon.-Sat.: 10 to 7  
Sun: 10 to noon  
**CARIBBEAN**  
**Aquatic Centres**  
Box 108, Road Town  
Tortola, B.V.I.  
(1 800) 345-6296 or  
Pa. residents (1 800) 362-5225

Monday-Saturday: 9 to 12, 1:30 to 5:30  
**Baskin in the Sun**  
P.O. Box 851  
Port-au-Prince, Haiti  
2-5773  
Daily: 9 to 5

**Buceo Dominicana**  
960 Abraham Lincoln Ave.  
Santo Domingo, Dominican Republic  
(809) 567-0346, 6116  
Monday-Friday: 8 to 12:30, 3 to 7

Saturday: 8 to 4  
Sunday: 8 to 12  
**Dive Bonaire**  
Flamingo Beach Hotel  
Bonaire, Netherlands Antilles  
(011) 5987 8285

Daily: 8:30 to 8  
**The Dive Shop, Ltd.**  
P.O. Box 448, St. Michael  
Barbados, W.I.  
(809) 426-9947, 2031

Daily: 9 to 5  
**Exuma Aquatics**  
P.O. Box 49 Georgetown  
Great Exuma, The Bahamas  
(809) 336-2600

Daily: 9 to 5  
**Exuma Aquatics**  
"La Cueva Submarina"  
P.O. Box 151  
Isabela, Puerto Rico 00662  
(809) 872-3903

Daily: 8:30 to 5:30  
**Provo Turtle Divers, Ltd.**  
Providenciales  
Turks & Caicos Islands, B.W.I.  
Daily: 8:30 to 5:00

**Tamariang Watersports**  
P.O. Box 247, The Valley  
Anguilla, B.W.I.  
(809) 497-2798, 2462

Daily: 9 to 5  
**UNEXSD-Underwater Explorers Society**  
P.O. Box F2433  
Freetown, Bahamas  
(809) 373-1244

Daily: 8 to 5  
**Virgin Islands Diving Schools, Inc.**  
P.O. Box 9707, Charlotte Amalie  
St. Thomas, V.I., 00801-3400  
(809) 774-8887, 7368

Monday-Saturday: 8 to 5  
**CANADA**  
**Alonso Diving Supply Ltd.**  
50 Quidi Vidi Village Rd.  
St. John's, Newfoundland  
(709) 753-6000

Monday-Saturday: 9 to 5  
**Bo-Lan**  
85 Lavigne St.  
Quebec City, Quebec G1R 1A8  
(1 418) 525-8883

Monday-Friday: 9 to 5:30  
**Dive Rescue-Sub Sea Experience**  
6928 104th St.  
Edmonton, Alberta T6H 2L7  
(403) 434-1433

Monday-Saturday: 9 to 5:30  
**The Divers Log/Nautilus School of Diving**  
619-64 Quinpool Rd.  
Halifax, Nova Scotia  
(902) 454-4296 or 453-2640

Monday-Wednesday: 10 to 6  
Thursday: 10 to 8  
Saturday: 10 to 6  
**Dean Centre**  
468 Burnside Road East  
Victoria, B.C. V8T 2X2  
(604) 388-7528

Monday-Saturday: 9 to 6  
Sunday: 9 to 1  
**Seafun Divers Ltd.**  
1761 Island Hwy.  
Campbell River, B.C. V9W 2A8  
(604) 287-3522

Monday-Saturday: 9 to 5:30  
**Seafun Divers Ltd.**  
300 Terminal Ave.  
Nanaimo, B.C.  
(604) 754-4813

Monday-Saturday: 9 to 6  
**Skin & Scuba Schools**  
#1, 3601-19th St., N.E.  
Calgary, Alberta T2E 658  
(403) 230-2365

Tuesday-Saturday: 10 to 6  
**BUENOS AIRES**  
**Argentine Diving**  
P.O. Box 100  
Buenos Aires, Argentina  
(54 1) 438-1111

## FOREIGN

### CENTRAL AMERICA

**Doc's Dive Shop**  
Cocoview Resort  
French Harbor  
Roatan, Honduras  
1 (800) 282-9322, (813) 973-0651

Mon.-Sun. 8 to 6  
**St. George's Lodge**  
Box 625  
Belize City, Belize C.A.  
011-501-44190

Daily: 24 hours  
**CYPRUS**  
**Ninos V. Michaelides Ltd.**  
(Ninos Sports)  
P.O. Box 262  
Limassol, Cyprus  
(051) 72667

Daily (Summer): 8 to 1, 4 to 7  
(Winter): 8 to 1, 2 to 6  
**MEXICO**  
**Aqua Safari**  
Av. Rafael Melgar 401  
Cozumel, O. Roo  
0152287-20101, 20661

Mon.-Sat.: 8 to 1, 4 to 6:30  
**Mulege Divers**  
Madero #45  
Mulege, Baja Ca. Sur  
Monday-Saturday: 10 to 1, 4 to 7

**MICRONESIA**  
**Palau Dive Center**  
P.O. Box 5  
Koror, Republic of Palau 96940  
Cable: Itarukor  
Daily: 9 to 6

**Water Sports, Inc.**  
P.O. Box 31 OHB  
Garapan, Saipan CMII 96950  
6664  
Daily: 7 to 9 p.m.

**REPUBLIC OF CHINA**  
**Double Power Enterprise Co. Ltd.**  
No. 152, Sec. 1 Chen-Kuo North Rd  
Taipei  
02-531-6631-541-1837

Daily 9 A.M. to 10 P.M.  
**SAUDI ARABIA**  
**Desert Divers**  
Al Rawdah Shopping Centre  
Prince Abdullah St.  
P.O. Box 160  
Jeddah-21411, Saudi Arabia  
(02) 660-8537

**SOUTH AMERICA**  
**Aqua Center Limitada**  
Enrique Meiggs #1960  
Quintero, Chile  
289  
Call for appt.

**Boz S.A.**  
Conquistadores 213  
Lima 27, Peru  
7-18962  
Call for appt.

**Octopus**  
(Instruction, Sales/Service Trips)  
Calle 5 No. 66-42  
Calle Valle, Colombia  
57 (83) 398024  
9 to noon, 3 to 7

**SOUTH PACIFIC**  
**Island Dive Services Ltd.**  
P.O. Box 414  
Honolulu, Solomon Islands  
22103 or Telex HO 66315  
Daily: 8 to 5

**Nautilus Dive Shop**  
B.P. 78  
Port Vila, Vanuatu, So. Pacific  
2398  
Daily: 7:30 to 11:30, 2 to 5:30

**Scubashire Ltd.**  
GPO Box 777  
Suva, Fiji Islands  
361-088  
Daily: 8 to 5

Robert Spies, above, obtains a sediment core sample. Dave Hardin and Spies, right, service an underwater thermograph. Sunlight produces the rainbow effect on seeping oil.

# New Data Surfaces From Oil Flow Below

A natural oil seep provides an offshore lab.

BY BRUCE WATKINS

**A**ll large oil spills capture the attention of the media and some have been major ecological disasters. These assaults on the environment can be expected to continue as long as we depend on oil and petroleum products shipped by sea. A major oil spill can have immediate, acute effects on marine birds and fishes, and can be devastating to beaches. In response, the oil companies have spent large sums of money to develop methods to contain and clean up spills before they reach the beach or sensitive marshes. But, what are the long-term effects of such a major spill?

This turns out to be a difficult question to answer, for major spills occur infrequently, making them difficult to study, and no one would propose to release a large volume of oil "just to see what happens." Crude oil is a mixture of thousands of different substances and after an oil spill, the composition of the oil and hence its potential effects begin to change, or weather, as the more volatile components evaporate and dissolve. Documenting the effects of a major spill requires the ability to quickly assemble field support and a scientific team to study a rapidly changing environment. This is not always possible to do. In addition, studying these spills in the laboratory provides little useful information because the effects of wind, waves, tides and sunlight are difficult to model. An alternative is to study a natural oil seep environment.

Bruce Watkins, Ph.D., is a research scientist with the Lawrence Livermore National Laboratory in California and an avid diver and underwater photographer.



The effects of oil on the keelp rockfish are as yet not known.

Natural seeps occur around the world and are thought to be responsible for about 10 percent of the six million metric tons of oil released to the oceans annually, which is comparable to the seven percent that is attributable to accidental oil spills. One of these natural seeps occurs offshore of Coal Oil Point, Santa Barbara, California and has been intensively studied by Marine Biologist Dr. Robert Spies of The University of California's Lawrence Livermore National Laboratory. This site provides an excellent natural laboratory to study the effect of oil on the marine environment. It releases a steady 50 to 70 barrels of oil daily and represents a worst-case situation of oil contamination. This area is continuously contaminated by fresh oil so weathering has a lesser effect in this environment and is usually not complicated by contamination with other pollutants, so effects measured here can be attributed directly to the oil.

Dr. Spies has been studying this area

since 1975, and is presently involved in a one-year program in which samples are collected from a heavily oiled area and a clean comparison area at two-week intervals. The purpose of this intensive sampling effort is to sort out seasonal variation in marine life at these sites and to better understand the effect the seep has on the marine community.

Growing up on National Geographic and Jacques Cousteau specials and being a scientist in my own right, I've often wondered what it would be like to dive for a living and to conduct research underwater. That opportunity came earlier this year when I was invited to participate in one of these field trips. My role in this venture was to be that of staff photographer to document the collection procedures for use in seminars and articles. I never mentioned I would have gladly paid to come along just for the adventure, rather than being paid.

We were met in Santa Barbara by Dane Hardin and Jim Bauer, scientists from Kinetic Laboratories, and Shane Anderson, a naturalist and collector from the Marine Science Institute at the University of California-Santa Barbara. The diving facilities were better here than at any resort I've seen. Racks of tanks and other equipment were maintained by a full-time staff; lockers were provided for our diving equipment and a warm air room for drying wet suits. This was an efficient operation and no time was lost hunting for equipment.

It was a cool, overcast day as we towed the boat to nearby Goleta Pier. The seep site was still several thousand yards away





but the strong smell was enough to make an oilman think of money — we just felt nauseous. Within minutes, the boat was lowered to the water and we proceeded first to the comparison site. This site is located a little less than one mile to the east of the seep site and was selected because of its similarity to the seep area in terms of bottom topography and marine life, and because the prevailing currents normally move the surface slick to the west.

The comparison site is located in 60 feet of water over a sand bottom and is marked by a buoy. Here the divers had two tasks: to obtain several sediment core samples and to retrieve and replace sediment traps which were installed two weeks previously. The divers suited up and were quickly on the bottom. These researchers do not use gloves while working underwater even though the water was a cold 53 degrees. They have a lot of work to do and would not be able to accomplish it all within the "no decompression limits" if they were slowed down by gloves. Every minute counted in the cold water. The bottom was laid out in a grid-like fashion with iron rod posts. To these rods were attached by Velcro straps the sediment traps, which consisted of a plastic tube containing a dense solution of salt and formalin. Sediment and small creatures were preserved as they fell into the tube, providing information on the rate of deposition and composition of newly formed sediment. These traps were arranged in a circle around the main buoy and in the low visibility (8-12 feet) water each station was located by attaching a length of rope to the buoy anchor and swinging around the site until all of the stations were serviced. While one diver attended to the sediment traps the other obtained core samples. These were collected by using homemade instruments, small plastic syringes which have had the ends cut off. These provided the divers with useful and inexpensive tools. As the

samples were collected they were neatly arranged on an organizer slate and collection information was carefully recorded.

This site consisted of flat sand bottom which was a hundred yards away from a large, dense bed of giant kelp, *Macrocystis pyrifera*. Large sea pens, *Pennatulacea*, dotted the sea floor, and two species of sanddabs skimmed along the bottom between the sediment traps. Opportunistic feeders such as the blue rockfish, *Sebastes mystinus*, were attracted to disturbances caused by the divers, hoping to find an easy meal in a diver's wake. Within the sand the core sampling revealed a thriving community of polychaete (bristle) worms, clams and crustaceans. For a sand bottom this area was rich in life.

The work was completed in 40 minutes and after a suitable surface interval, we proceeded to the seep site. Diving here was conducted somewhat differently than at the first site, mainly to minimize the diver's contact with the oil. The boat hung back from the site while the divers geared up, to avoid the strong smell of the vapors which percolated up from the sea floor. The ocean was glassy that morning and as we approached, the slick spread out across the surface of the water and slowly drifted into the kelp bed. Large chunks of tar bobbed on the surface. The sun danced on the surface as the oil reflected the light back in a rainbow of color. This site is not only marked by a buoy but also by a scarecrow. It seems that a previous diver had mistakenly grabbed the oil covered buoy and his oil-soaked glove was left as a warning to others. It also foreshadowed the next dive.

In order to avoid oil contact with the divers' wet suits and equipment, the boat made a sharp turn as it arrived to disperse the slick and the divers quickly entered through the break before it had a chance to close up again. The work to be done was similar to the previous site, except, here there were two areas to be

sampled, an area of moderate seepage and one of heavier seepage named "super seep." Diving was an eerie experience. Bubbles of natural gas belched out of the sea floor, at times the flow was strong enough to be confused with divers' bubbles. Neutrally buoyant droplets of oil floated through the water, seemingly searching for a wet suit on which to adhere. Chunks of tar rolled along the bottom with the current. Oil vapor irritated our eyes and skin. This was not a fun place to dive.

Except for the presence of the oil, this site was much like the previous one. The marine life was quite similar in distribution but was more concentrated at the seep site. The core samples revealed large amounts of oil within the sand. As the samples were being collected a large electric ray, *Torpedo californica*, swam by and checked out the divers. Here also occurs large white mats of the bacterium, *Beggiatoa*. These bacteria thrive on the oil and hydrogen sulfide (the substance which gives the odor to rotten eggs) found here and actually utilize hydrogen sulfide the way plants use sunlight to convert carbon dioxide into sugar and turn out to be important members of the seep community. Perched atop one of the last sediment traps was a small octopus, *O. rubescens*. This sandy bottom provides little shelter for such a creature and this specimen was apparently trying to find a home in the scientific equipment. It is not known to what extent these inquisitive creatures effect the measurements obtained here. Detailed information on visibility, currents and surface conditions were recorded to be later correlated with seasonal variations in the sampling data. The water temperature was continuously monitored by a recording thermograph which was attached to the anchor at the seep site. This instrument has batteries and chart paper to last for 3 months and needed servicing on this trip.

Returning to the boat through the oil slick is somewhat of a ritual. The divers approached the surface and blew a large bubble column to disperse the slick. One then surfaces, signals the boat and slips below the surface. The boat returns, dispersing the slick with its wake and the divers quickly board, hopefully untainted. Our wet suits got by with only a few small stains, however, the fins had acquired large masses of tar from being unintentionally dragged over areas of heavy seepage on the sea floor. After an hour of cleaning with rags moistened in kerosene the gear was almost as good as new.

While divers are useful for the collection of sediment and animals which can't swim away, the collection of free swimming animals requires trawling a net. Several trawls were obtained from each site during our two-day trip and the results



Researchers examine "catch" from trawling operation.

were surprising. At the control site, several pounds of opossum shrimps, *mysids*, were collected with a large assortment of sanddabs. Each fish was preserved with formalin in its own container for more careful classification and examination of stomach contents back at the lab. This was a difficult task in the rocking boat since several hundred fish were collected and the smell of formalin and oil produced a nauseating combination. At the seep site about one tenth as many mysids and fish were collected. Is this a significant observation? Probably not. Two weeks later at the same sites the situation was reversed in that many more mysids and fish were collected at the seep site. This probably reflects local schooling of the shrimp with concurrent localization of

their predators and has nothing to do with the seep, emphasizing the need for multiple samples over long periods of time before drawing conclusions.

What are the differences between the control and seep sites? What long-term effect does the oil have on the marine life? The answers are all not in yet but this is what is known to date. First of all, there is a higher concentration of marine life at the seep site. Anaerobic bacteria deep within the sediments feed on the oil and produce hydrogen sulfide which trickles up through the sand. At the interface between the anaerobic and aerobic environments, usually at the sediment surface, bacteria of the genus, *Beggiatoa*, feed on the hydrogen sulfide and other bacteria on the oil. This increased concentration of bacteria is in turn preyed upon by other sediment dwellers such as clams and polychaete worms which are in turn preyed upon by starfish and the fishes. The concentration of marine life is therefore much greater at the seep site, although the variety at the two study sites is very similar suggesting that the oil is actually of some benefit. In fact, 14 percent of the carbon found in the sand dwelling worms of the seep community originates from the oil.

The concentration of oil in the water here is in the parts per billion range where after an oil spill it can be in the parts per million. The seep site is therefore much less toxic and the organisms found here have adapted to this moderately toxic environment. Two species of sanddabs at the seep site were found to have higher levels of an enzyme system called mixed-function oxidase when compared to the less contaminated area. These enzymes are responsible for the detoxification of materials within the livers of most animals by converting them to less toxic, readily excreted materials. This is an inducible system in that the presence of oil or other toxic substances causes the production of more enzyme and is one form of adaptation.

It was also suspected that because this area has been leaking oil for the last 2,000 years or so, that the organisms have evolved to better handle the detoxification of oil. This hypothesis has not been substantiated to date. In one species of starfish, the oil proved to be just as toxic to specimens from the seep site as those from clean areas. It may be difficult to find organisms which have evolved to better deal with the oil because the seep area is rather small and intermixing of organisms is common from non-seep areas. More research is needed to identify the more subtle adaptability of this community.

The diver/researchers have adapted to their working environment as well. Their working dives are so frequent that they have developed a system to minimize both preparation and bottom time. Everyone involved was enthusiastic about the scientific aspects of their work but not about the diving. Dr. Spies enjoys doing this kind of field work because it provides short term rewards in contrast to laboratory work which may take years to measure anything significant. Diving was merely a tool for him and hard work at that. When asked about pleasure diving, none of the researchers had done any in years. "It would be like a postman taking a walk on a Sunday afternoon." Such is human nature.

**S**

## WATER RESCUE SYSTEMS

**MANUFACTURERS OF**  
Rescue Suits, Emergency  
Line Systems, Reusable Line  
Systems, Rescue Belts

**DISTRIBUTORS OF**  
Inflatable Boats, Line  
Launchers, RSQI, Complete  
Line For Water Rescue Teams

59 Washington St.  
Somerville, MA 02143  
1-800-328-2881

Enjoy live-aboard diving with boats from La Paz, the Red Sea, Cayman Brac, Seychelles, Australia, Belize, the Philippines and Maldives. Many resort ventures also available.

## Sea Safaris

3770 Highland Ave. Suite 102  
Manhattan Beach, CA 90266  
(800) 821-6670 (213) 546-2464  
In CA (800) 262-6270  
Telex: 664860 SSAFARIS



# COME ABOARD





Bars of rubber compound are placed on molds prior to pressing. Photo at left, shows various materials used to make compound for Jet Fins.



# From Start to Fin

There's more to making a Jet Fin than meets the eye.

BY ERIC HANAUER

**W**e all probably take our fins pretty much for granted. After all, they're not a high tech item and they don't require a lot of care or attention. Forget to wash them for a year or so and they show no ill ef-

fects. Once in a while a strap will break, or one might get lost in the surf, but in the great scheme of things there isn't much to a fin. All you do is put them on your feet and kick. Right? Wrong.

I recently visited Hydro Rubber Company and observed the making of the legendary Lightning Jet Fins from the raw materials to the finished product. I came away with a new respect for an aspect of our sport little known or understood by

the average diver. After all, without rubber products a diver would be worst off than a car without tires. Rubber products are used in nearly every piece of diving gear in one form or another. And if it weren't for the men tapping trees in the jungles of Malaysia, and the workers at the rubber plant, we wouldn't be diving at all.

Most diving equipment manufacturers buy their rubber products overseas. Some buy them from OEM (original

A scuba instructor for 23 years, Eric Hanauer is the diving officer at California State University, Fullerton. His articles and photographs appear regularly in national magazines as well as those in foreign countries.

equipment manufacturers) who make products for several different companies. Scubapro is unique in having its own rubber factory.

Founded 10 years ago when Scubapro bought an existing firm, Hydro Rubber, is now owned by Undersea Industries (Scubapro). Located about 10 miles from the parent company, it is a separate operating entity. Hydro Rubber also makes such things as pistol grips, sanding pads, and rubber parts for aircraft. But their primary user is Scubapro, accounting for the major part of total production.

Jim McGee, head of engineering and planning facilities, was my guide. Anything Jim doesn't know about rubber products probably isn't worth knowing.

First, Jim showed me a pallet loaded with slabs of a brown, gooey material; some white, yellow, and blue powder; a couple of bags of granular stuff, and some cups of evil looking liquid. It was hard to believe that these chemicals would eventually wind up as a shiny new fin. "Every product has its own recipe," Jim explained, "and this is what we use to make Lightning Jets." Different characteristics are programmed into each part of each product to result in the traits we take so much for granted. For example, foot pockets should be soft and flexible; the blade should be stiff with good rebound characteristics. Therefore, a different compound is used for the two parts of the fin.

The process begins with a "smoked sheet." The soft, pliable, translucent material has a sort of hickory smell, because natural rubber must be treated to kill bacteria, before shipping. Otherwise it would rot before it reached the plant. So the natural rubber sheets are smoked like salted fish. This material comprises about 40 percent of a Lightning Jet Fin.

The next ingredient is carbon master batch. Its black color looks more appropriate for fins than the brown smoked sheet. Actually, this is a compound of carbon and synthetic rubber, which arrives at the factory premixed. These materials provide tensile strength (tearing resistance) and have the ability to stretch and return to their original shape. Aging characteristics are also improved by the addition of carbon. That's why black fins usually outlast colored ones.

Resin is added as a filler or reinforcing agent. This gives the rubber its stiffness; the more carbon and resin the harder the compound. Most manufacturers use clay as a filler because it is cheaper. But clay is also heavier, twice the weight of resin. With a resin filler, the Lightning Jet Fin's specific gravity is nearly one, so it would float if it weren't for the metal strap retainers.

The remaining ingredients include things I never expected to find in a fin.

Petroleum helps to incorporate the dry ingredients into the rubber. Waxes offer protection against ozone and oxidation. For curing, sulfur and zinc oxide are included. Stearic acid serves as an internal lubricant, making the batch easier to process. Activators or catalysts speed up the chemical reaction.

The ingredients are carefully weighed and fed into a high-pressure mixer. This machine can grind and pulverize 125 pounds of compound in five minutes. It comes out in a gooey, black mass that looks like licorice taffy. Next, it is fed into a mill where cylindrical steel rollers form it into sheets. The friction generated by the rollers heats the rubber to 200 degrees. The final chemicals, activators, are added at this stage. Looking more like rubber now, the sheets are cut from the rollers by hand and are fed into another machine called a barwell free former. There, more heat and pressure form the sheet into a long bar, where it is cut into shorter bars by a die.

At this stage, the rubber is still uncured. It will be subjected to more heat and pressure to achieve vulcanization. "Vulcanization," said McGee, "is a chemical cross-linking of the hydrocarbon chain."

"Of course," I replied, "I knew that." He explained, anyway, that uncured rubber is unstable, and lacks chemical resistance. Vulcanization, a chemical change as radical as burning a piece of paper, gives it stability. A totally different material comes out of the press after 20 minutes at 300 degrees, and 450 tons of pressure.

But before going to the presses, each

batch is tested in the laboratory. There, a mini press evaluates the material for consistency and hardness. A graph is drawn from the sample, and if it doesn't meet production specifications, the entire batch is discarded. The good stuff moves on to the presses.

The presses are perhaps the most interesting part of the process. After spraying the molds with lubricant, a worker places a couple of small bars on the foot pocket and a couple of large ones on the blade portion of the mold. Separate metal blocks will form the vents. A switch is thrown, the molds come together, and rubber slowly squishes out as the fins cook for 20 minutes under high temperature and pressure. When the pressure is released, eight new fins lie steaming in the molds. At this point, they look almost like the fins we take diving, except for a lot of extra rubber around the edges. This is called *flash*, and must be trimmed off at another station. Heated scrapers and scissors are used for this operation.

Only the final steps remain. The fins are buffed, then washed in a machine to get rid of rubber dust and trimmings. Then they are tumbled in an industrial dryer — without heat — along with a bunch of rags. The rags are impregnated with silicone to give the fins their final shiny protective coat. Buckles and straps are attached and they are boxed for shipping.

A 150-pound batch of rubber will make 25 pairs of fins. In full production, Hydro Rubber can turn out 65 batches a day, or

Worker removes fin from press. Flashing must still be removed.





Worker scrapes flashing from fin. Buffing and cleaning are the final steps.

1,625 pairs of fins. They also make hoses, mouthpieces, exhaust tees, snorkels, masks, and parts for diving equipment.

One section of the plant is devoted entirely to silicone products. Scubapro first started using silicone in masks because

of its hypo-allergenic properties. It won't cause skin irritation to sensitive people. The clear masks caught on quickly because they look good in photographs and they let in more light, counteracting the claustrophobic effect of rubber

masks. Silicone also won't deteriorate in sunlight or in the presence of oils as rubber does. However, it has a few disadvantages. It is more expensive, has only a third the strength of rubber, and tears more easily. It also lacks the memory — rebound ability — of rubber. Finally, it tends to absorb color from other materials. If a rubber snorkel or tab is used on a silicone mask strap, for example, the strap will turn brownish as it absorbs carbon from the rubber.

In Scubapro regulators, silicone exhaust valves and diaphragms last much longer, perform better and have made rubber ones obsolete. In masks and mouthpieces, the positive characteristics of silicone are rapidly taking over the market.

The raw material of silicone is silica — sand. Depending on how it is processed, it can take on a glasslike form as in computer chips, or a polymeric form as in masks. Produced in Germany, it arrives at the Hydro Rubber plant in the form of pliable slabs. They feel soft and slightly gooey, because they haven't been vulcanized yet. Unlike rubber, silicone products don't require a lot of additives. Organic peroxide acts as a curing agent, and dye is added just for a tint. A little bit of it goes a long way. That's all. Vulcanization occurs in molds under heat and pressure, just as in rubber products.

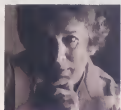
McGee doesn't like the term "silicone rubber." He explains that rubber forms a double bond between hydrocarbon molecules, silicone doesn't. "Silicone polymer" would be a more accurate term.

Besides rubber and silicone products, Hydro Rubber also produces plastic products including boxes, flashlights, and regulator housings. Hydro bought a plastic company a year ago, primarily to make parts for Scubapro.

Working in a rubber plant can be hazardous. Health and safety precautions were evident throughout to safeguard the workers. Dust is perhaps the worst hazard, and high powered vacuum dust collectors are located everywhere it is generated. Only trained people, indicated by the orange vests, are allowed in the areas of the large machines. Presses have two-hand controls, making it impossible for a worker to get a hand caught while they are closing. The mills have safety brakes and trip wires, which are tested at the beginning of each shift. Labels on the machines are in Spanish as well as English. Arm guards, safety glasses and ear protection are provided where needed. Hydro rubber works around the clock to meet the needs of its customers.

I left with a greater understanding and appreciation for the role rubber plays in my favorite activity. It's reassuring to know that great care is taken in the manufacturer of gear we divers take for granted. **\$**

## "ONE DAY MOTHER MADE US CHANGE OUR SHORTS THREE TIMES." —Tim Boyle



When we first came up with a line of new shorts, everyone was excited. Except the company President, my mother. "Too ordinary," she sniffed.

So we looked for extraordinary touches. And found some. Like great madras prints that reverse to our unique Dirigible™ Cloth. Result: A real pair of shorts. Two in one.

We added slash pockets, a wide waistband and a comfortable, generous cut. Then engineered them to typical Columbia high stress specs.

Now, after all these improvements, we are *really* excited.

And so's Mom. To quote her jubilation, "They'll do."



**Columbia**  
Sportswear Company

For color brochure,  
send \$1 to us at 6600 N. Baltimore,  
Dept. AF, Portland, Oregon 97203.

diver per week.

Regardless of booking agent, prices for both the "Encantada" and "Amigo I" include all meals aboard ship, island sightseeing, guide and lecture services, transfer in the islands including between the airport and ship. It also includes tank, backpack and weight belts. Divers need to bring all their own equipment, and present both a certification card and a recent medical certificate stating they are fit for diving. An indemnity form releasing the ship and its crew from liability must also be signed.

Between one and three dives are planned for each day, depending on the boat's sailing schedule. Although some of the islands are close to one another, the more remote ones require a fair amount of time under power to reach them. This travel is normally done at night, leaving the days free for diving and island sightseeing.

The diving opportunities are extremely varied. The inshore marine species include black coral trees which are actually a flaming bright yellow; Hellaster starfish in a host of colors, including green, orange, red and yellow; urchins with blunt pencil-shaped spines that bore into the solid volcanic rock; and green turtles that can be found sleeping on the sides of the volcanoes.

Of all the amazing creatures, nothing compares to the friendly and playful sea lions. Closely related to the California species, they always seemed as delighted to see us as we were to see them. They would continually swim out to meet our panga, sometimes surfing in our wake or swimming upside down in the propeller wash, even splashing up the rocky slopes to greet us as we landed.

One of the favorite tricks of the young pups was to suddenly charge, hoping we would turn and run away. When that happened, they would bark uproariously. If we stood our ground, they would almost sheepishly touch someone's leg, their bluff called. However, the one time it was advisable to move was whenever a large bull (male) sea lion began to act menacing; they protect their territory and their harem fiercely. They have on rare occasion injured foolhardy tourists who couldn't tell between a clowning sea lion and a beligerent one. Hint: it's in the roar.

Sea lions look so clean and sleek it comes as a bit of shock to discover their breath smells like a three-week old dead fish. They made better close-up companions underwater, where they proved just as roudy as on land. They would porpoise through the water, somersault over a snorkeler, even body surf on the wave crests rolling into shore. Best of all, they



Newborn sea lion is both fearless and curious. The absence of predators accounts for the tameness of the animals on the Galapagos.

were never bashful about having their picture taken. On shore, they would even pose for long periods, with a flipper held high or a nose pointed loftily skyward.



One creature you don't see as frequently as you'd expect is the large land tortoise. Introduced animals, such as goats, pigs, feral cats, dogs, and rats have reduced their populations substantially. The goats in particular have had a devastating effect, consuming and destroying the vegetation the turtles need to survive. For example, a colony of only four goats on one island multiplied to a population of over 100,000 in just a few decades.

Thanks to the efforts of the Galapagos park service and the Darwin Research Station on Santa Cruz Island, headway is being made at reducing the predators and re-establishing the tortoises. The Galapagos made headlines in the U.S. recently because of a large fire on one of the islands, but I never saw evidence of it. The fire was confined to one area of Isabela Island in a section not normally visited by tourists.

For information on chartering "Encantada" or "Amigo I" directly, write Adventure Associates, 13150 Colt Road, Suite 110, Dallas, TX 75240; phone (214) 357-6187. They are the U.S. agents for Metropolitan Touring of Ecuador, which operates both dive boats. Other boats are available for charter through Metropolitan but they are not all fully equipped to accommodate divers.

To find about joining an existing trip, write See & Sea Travel Service, 680 Beach St., Suite 340, Wharfside, San Francisco, CA 94109 or La Mer Diving Safari, Inc., 823 UN Plaza, Suite 810, New York, NY 10017.

**S**



## Strippin' (Continued from page 14)

absence of water, will crystallize out forming visible lumps of pure, and digestible salt. As ice can cause rocks to split, salt is hard enough to crack the glaze. The surface will splinter until a plate may resemble a spider web, a condition known as "checking." Soaking in fresh water will force the sodium and chlorine to stay ionized until flushed out.

### Iron and Steel

At first glance one might wonder why anyone would bother to recover ships' parts made of iron and its carbon alloy counterpart, steel. Rusting hull plates have very little intrinsic value other than as scrap. But many interesting finds, from anchors to cannon balls, are in sharp demand by collectors.

All iron products rust more rapidly when removed from the sea. As the metal dries, air enters the pores and the presence of so much free oxygen accelerates oxidation — the cause of rust. This unwanted iron oxide forms flakes, and will chip off until nothing is left but a handful of dust.

Here, instead of acid, we must use a basic solution not only to rid the iron of marine growth, but to prevent its collapse. Prolonged soaking in water with 10 percent lye, obtainable at the neighborhood supermarket, starts the preservation process. For fairly new ironmongery this phase can be completed in a couple of months, but for real antiques such as cannon balls, old rifles, or arquebuses, upwards of a year is necessary.

A plastic container must be used, not because the lye will dissolve a metal pail, but because the iron hungry iron object will strip the galvanized coating off the bucket. The liquid will then escape through thousands of tiny pinholes. There will be no effervescing since marine growth is not readily dissolved, but only loosened at the iron-organic interface. However, the bath should be tightly sealed to prevent people — especially children — from putting their hands into it as it looks just like water. Lye is just as reactive as acid, but on the other side of the pH scale.

After the long soaking any encrustation can be scraped off. Now we will accede to the iron's demands and galvanize it. This is nothing more than the addition of zinc, a metal which prevents electrolysis in iron by having more ionic potential. Boat owners know that zinc blocks must be attached to the hulls of their craft near the propeller shaft and rudder for this purpose. Buy the zinc at a boat yard or scrap metal dealer.

Hold the blocks about six feet in the air, over the lye solution, and melt them with a propane torch. This allows the droplets to cool slightly before hitting the liquid,

where they will spatter and form an oddly shaped piece of shrapnel with a large surface area per volume. When cool, put on rubber gloves and pack the zinc shards around the iron so the object is completely covered. Let it sit for a couple months until the galvanization process is complete.

Remove the artifact and let it dry. Now you can either leave it alone, apply several coats of clear acrylic, or paint it black with a rust proofing spray paint, as desired.



For something as large as an anchor, unless you have a swimming pool you do not mind converting into a preserving bath, you will have to forego a treatment process. But, because the object is so thick, there will usually be plenty of solid material left once the surface flakes are chipped, scraped, or sand blasted off. In this case make sure you do a good job of sealing with acrylic or paint in order to prevent further oxidation. And if the object is to be left outside in the elements, where weathering and natural sand blasting will present a problem, be sure to re-seal it at least once a year — more if you live at the shore.

### Wood, Leather and Paper

These are all organic substances in that they were once parts of living plants and animals. Being animal and vegetable, rather than mineral, they are susceptible to the same problems encountered by all natural fabrics and boards — being eaten. They are, in essence, biodegradable.

Besides cellulose reducing bacteria, the aquatic tereido is the most prevalent and most voracious predator. Contrary to popular belief, this tiny animal is not a worm, but a wood boring mollusk. Unless wood is covered by sand or silt, it is soon

riddled with holes as these little creatures literally eat out their homes.

Barring these conditions of survival, over which we have no control, the real problem with wood, and its affiliate substances, is shrinkage. The living matter from which these artifacts are made contain cells, each one a microscopic cube with six flexible walls.

When submerged for long periods of time wood swells as water enters the cell structure through osmosis. The resultant internal pressure pushes outward on the cell walls, bowing them. Each little bow, multiplied millions of times, becomes visible as swelling.

After the wood dries the cell walls, which have been stretched like a rubber band, lose their elasticity, causing each cell to shrink to less than its original size. Cohesion between the cells must give, causing the object to crack due to this undue stress. It is this shrinkage we must control.

The first call of order is not to allow the object to dry out. After recovery, keep it wet either by submersion or, where this is not possible, by wrapping in plastic — the condensation will suffice to keep it damp enough until you get it home. As soon as possible, start soaking in a freshwater bath to flush out the salts and minerals. According to the age of the wood and the time it has spent underwater, this phase could take anywhere from one month to six. Small objects I stick in the toilet tank where there is a constantly changing supply of good, clean water.

If there is unwanted marine growth, such as a coating of coral, it can be removed by a muriatic acid dip as the acid will not harm the wood. But if there is attached iron, such as the band around a deadeye, this method cannot be used since the acid will dissolve the metal. Also, it is best to do the acid treatment in the beginning so the fresh water can flush out the chlorine.

For actual preservation, however, we need to imbue the cell structure with a chemical strengthener. Acetone works well on newer wood, and antifreeze can be used in a pinch although the coloring agent may tint the final product. Antifreeze is a gasoline byproduct known as ethylene glycol, chemical formula  $\text{OH}-\text{CH}_2-\text{CH}_2-\text{OH}$ . This is the simplest polyhydric (many hydrogens) alcohol, with a molecular weight of 63.

Better than this is polyethylene glycol (PEG). This is a chain of ethylene glycol molecules linked together into any desirable length, or molecular weight, depending on the intended usage. For our purposes 4,000 molecular weight is the best, although the more readily available 3,350 is almost as good. Check your local commercial chemical outlet for availability and price — be forewarned, it is expen-



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES



**BUSINESS REPLY MAIL**

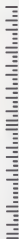
FIRST CLASS PERMIT NO. 39, ORANGE, CA

POSTAGE WILL BE PAID BY ADDRESSEE

**SCUBAPRO®**

**Diving & Snorkeling**

P.O. Box 14003  
Orange, California 92667



# BREATHING EASIER

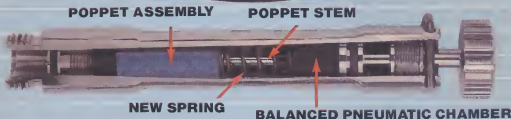
Longer service life  
Easier Flow hose  
P.C. Silicone Protected Environmental Cap  
Multiple high and low pressure ports  
Performance comfort

Remarkable dependability combined  
with balancing produces more  
enjoyment for your diving.

Contact your Authorized  
**SCUBAPRO Dealer** for  
a complete demon-  
stration TODAY.



**NEW  
FACE  
PLATE**



## NEW PNEUMATICALLY BALANCED DEMAND VALVE CONVERSION KIT

3105 E. Harcourt, Rancho Dominguez, CA 90221  
100-page Equipment Selection Guide and Scubapro Diving Adventure  
Magazine available at Scubapro Dealers

**SCUBAPRO®**

## Strippin' (Continued from page 14)

absence of water, will crystallize out forming visible lumps of pure, and digestable salt. As ice can cause rocks to split, salt is hard enough to crack the glaze. The surface will splinter until a plate may resemble a spider web, a condition known as "checking." Soaking in fresh water will force the sodium and chlorine to stay ionized until flushed out.

### Iron and Steel

At first glance one might wonder why anyone would bother to recover ships' parts made of iron and its carbon alloy counterpart, steel. Rusting hull plates have very little intrinsic value other than as scrap. But many interesting finds, from anchors to cannon balls, are in sharp demand by collectors.

All iron products rust more rapidly when removed from the sea. As the metal dries, air enters the pores and the presence of so much free oxygen accelerates oxidation — the cause of rust. This unwanted iron oxide forms flakes, and will chip off until nothing is left but a handful of dust.

Here, instead of acid, we must use a basic solution not only to rid the iron of marine growth, but to prevent its collapse. Prolonged soaking in water with 10 percent lye, obtainable at the neighborhood supermarket, starts the preservation process. For fairly new ironmongery this phase can be completed in a couple of months, but for real antiques such as cannon balls, old rifles, or arquebuses, upwards of a year is necessary.

A plastic container must be used, not because the lye will dissolve a metal pail, but because the ion hungry iron object will strip the galvanized coating off the bucket. The liquid will then escape through thousands of tiny pinholes. There will be no effervescing because marine growth is not readily dissolved, but only loosened at the iron-organic interface. However, the bath should be tightly sealed to prevent people — especially children — from putting their hands into it as it looks just like water. Lye is just as reactive as acid, but on the other side of the pH scale.

After the long soaking any encrustation can be scraped off. Now we will accede to the iron's demands and galvanize it. This is nothing more than the addition of zinc, a metal which prevents electrolysis in iron by having more ionic potential. Boat owners know that zinc blocks must be attached to the hulls of their craft near the propeller shaft and rudder for this purpose. Buy the zinc at a boat yard or scrap metal dealer.

Hold the blocks about six feet in the air, over the lye solution, and melt them with a propane torch. This allows the droplets to cool slightly before hitting the liquid,

where it shapes surface on rub shards complete months complete. Remember you can coat with a sired.



**Subscribe Now And Receive Every Issue**



# SCUBA PRO® Diving & Snorkeling

- Adventure
- Fiction And Non-fiction Articles
- Travel
- Latest Equipment And Technical Breakthroughs
- Humor And Trivia
- Exciting Color Photography

For something as large as an anchor, unless you have a swimming pool you do not mind converting into a preserving bath, you will have to forego a treatment process. But, because the object is so thick, there will usually be plenty of solid material left once the surface flakes are chipped, scraped, or sand blasted off. In this case make sure you do a good job of sealing with acrylic or paint in order to prevent further oxidation. And if the object is to be left outside in the elements, where weathering and natural sand blasting will present a problem, be sure to re-seal it at least once a year — more if you live at the shore.

### Wood, Leather and Paper

These are all organic substances in that they were once parts of living plants and animals. Being animal and vegetable, rather than mineral, they are susceptible to the same problems encountered by all natural fabrics and boards — being eaten. They are, in essence, biodegradable.

Besides cellulose reducing bacteria, the aquatic teredo is the most prevalent and most voracious predator. Contrary to popular belief, this tiny animal is not a worm, but a wood boring mollusk. Unless wood is covered by sand or silt, it is soon

ply of good, clean water.

If there is unwanted marine growth, such as a coating of coral, it can be removed by a muriatic acid dip as the acid will not harm the wood. But if there is attached iron, such as the band around a deadeye, this method cannot be used since the acid will dissolve the metal. Also, it is best to do the acid treatment in the beginning so the fresh water can flush out the chlorine.

For actual preservation, however, we need to imbue the cell structure with a chemical strengthener. Acetone works well on newer wood, and antifreeze can be used in a pinch although the coloring agent may tint the final product. Antifreeze is a gasoline byproduct known as ethylene glycol, chemical formula  $\text{OH}-\text{CH}_2-\text{CH}_2-\text{OH}$ . This is the simplest polyhydric (many hydrogens) alcohol, with a molecular weight of 63.

Better than this is polyethylene glycol (PEG). This is a chain of ethylene glycol molecules linked together into any desirable length, or molecular weight, depending on the intended usage. For our purposes 4,000 molecular weight is the best, although the more readily available 3,350 is almost as good. Check your local commercial chemical outlet for availability and price — be forewarned, it is expen-

# EXCELLENCE IN BREATHING

## ENJOY YOURSELF MORE

Nearly 20 years ago, SCUBAPRO first introduced the Adjustable Second Stage to the diving marketplace. Now in 1985 SCUBAPRO introduces a dramatically improved model. The improvement is accomplished by pneumatically balancing the downstream valve.

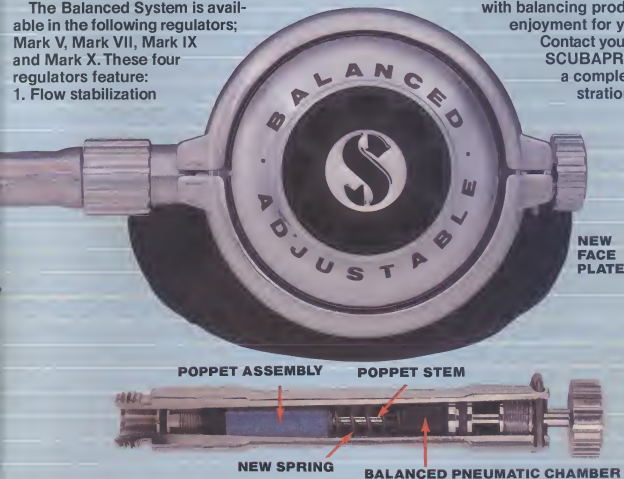
The Balanced System is available in the following regulators; Mark V, Mark VII, Mark IX and Mark X. These four regulators feature:

1. Flow stabilization

2. Longer service life
3. Super Flow hose
4. S.P.E.C. Silicone Protected Environmental Cap
5. Multiple high and low pressure ports
6. Performance comfort

Remarkable dependability combined with balancing produces more enjoyment for your diving.

Contact your Authorized SCUBAPRO Dealer for a complete demonstration TODAY.



### NEW PNEUMATICALLY BALANCED DEMAND VALVE CONVERSION KIT

3105 E. Harcourt, Rancho Dominguez, CA 90221  
100-page Equipment Selection Guide and Scubapro Diving Adventure Magazine available at Scubapro Dealers

# SCUBAPRO®

sive. PEG comes in either liquid or powder form. If it comes as a powder it must be mixed with water according to instructions.

The way it works is this. By impregnating the cell walls the chains intertwine like billions of miniature ball-point pen springs, adding structural stability to the weakened members. Leave the bath uncovered so the water can evaporate. This concentrates the PEG and forces more of it into the cells.

This should be done for a minimum of six months — longer if the wood is very old. Archaeologists in England have soaked thick oaken planks of Roman vintage for as long as two years in order to be assured that the PEG penetrates all the way to the interior cells — and for some woods they recommend that as long as 10 years may be necessary.

This method, the best there is, is not perfect. There will still be some shrinkage, perhaps as much as 10 percent, but usually not enough to cause serious damage. In the case of coral encrusted wood this can be advantageous. The coral will not shrink as the wood drops away from it, and eventually it will crack and flake off.

Now, more than a year later, the wood can be left natural, or it can be coated. Varnish and shellac leave a store-bought glossy look which, if you like it, is fine. Otherwise, use it only when necessary to hold crumbling parts together. Sprayed polyurethane will give a natural finish while providing protection as well as a sealant. The wood can be sanded and rubbed with linseed oil to give a nice, waxy finish reminiscent of sea faring days.

Follow these same procedures for leather and paper, taking care to keep paper flattened between two sheets of glass to prevent it from curling. And, because of the thinness of paper, a much shorter treatment time may be used.

As you can see, many of the procedures described require months, if not years, to adequately preserve or restore marine artifacts. But this time is purely subjective — it does not require vast amounts of work on your part, only patience.

Although we are all eager to display our finds as soon as possible, eagerness is self defeating for the artifacts must necessarily suffer for this haste. Things painstakingly polished will have to be repolished, or completely redone; things improperly preserved will be lost irretrievably.

Take the time to do it right the first time and you will be rewarded. You can then display your artifacts with pride, and without fear that they will be destroyed due to your lack of industry.

Any artifact worth taking, is worth preserving. **\$**

## Red Sea (Continued from page 52)

and grey coloration that's actually quite pretty. These animals begin to emerge from their diurnal lairs at dusk, but it takes white light (such as the one cast by a dive light) to display their coloration.

In order to avoid accidentally landing on a crown-of-thorns I've been resting my fins on the sand patch around the coral head. The surface of the sand is crisscrossed with wavy lines, some of which I may have made myself. But what made those long ones? On Bonaire I track olive shells by following their trails; these indentations are much deeper and much longer than the ones the olive shells make. I find the end of one trail, dig down, and unearth a beautiful brown and beige and white auger shell that's six inches long! The next trail reveals an eight-inch-er! I continue to dig up and re-bury auger shells just to see how big they are until



Short-spined urchins use their tube feet to move along the bottom.

one trail yields not an auger, but a cone shell. Since I can barely tell a dangerously-venomous cone from an ice cream cone in these unfamiliar waters I decide it's time to stop digging, at least with my bare hands.

On this and the next few night dives there isn't much that's unexpected. Groupers, surgeonfish, butterflyfish, and other fish active in the daytime change their coloration for the evening and rest along the bottom or in crevices in the coral. Some parrotfish snooze in mucus cocoons they secrete nightly. Clownfish sleep, cuddled within the tentacles of their anemones. Stony coral polyps expand and feed.

It wasn't until I began to look at very small things that I got some surprises. Resting on a branch of fire coral was a tiny crab. It reminded me of an arrow crab, but it was sort of fuzzy and its shell had two

points instead of one. A close examination of a sea fan revealed a tiny almost-invisible shrimp. Sleeping atop a leathery coral was a small goby-type fish. A shiny dark object resting on the sand caught my attention — a juvenile cowry taking an evening stroll.

One night my exploring light beam rested on a blue-green octopus. I managed to get one photo before the octopus oozed under a coral head. To avoid frightening the octopus I turned my light off and waited quietly; at what I hoped would be the opportune moment, I turned my light on again and illuminated the octopus as it crossed an open area. This time I was able to place my hands beneath the animal and lift it gently off the bottom. My buddy and I "juggled" the octopus between us for a while. Since it didn't ink we felt it was comfortable with our attentions. When the octopus left us, it first swam through the water, then walked along the bottom, and then squeezed into a tiny hole in the sand and disappeared. That was certainly a behavior we wouldn't see in the daytime!

We turned our lights off again in the hope the octopus would reappear. While we waited I realized there was something funny about the bioluminescence around us. Instead of being little tiny lights that only sparkled for a second, I was seeing much larger lights staying on for much longer periods of time. Slowly, I advanced on one of the lights and switched my own light on a small fish with a pocket of luminescence around its eye. It was a flashlight fish, one of the animals I'd most wanted to see in the Red Sea.

Although they're very shy, I could often get quite close to flashlight fish by swimming slowly and either aiming my light beam off to the side or turning the light off. The flashlight fish weren't very good subjects for photography but they were wonderful to watch. We could see them on any night dive as long as we remembered to look.

Another wonder that turned up on some of our Red Sea night dives was actually a duo: hermit crabs who kept their own "pet" sea anemones on their shell homes. This partnership is a well-documented symbiotic relationship. The hermit crab is protected by the stinging tentacles of the anemones, and the anemones benefit by eating the crab's food scraps. If we suddenly shined our lights on one of these crabs, it would duck into its shell in a way that best displayed the anemones; then, after a while, it would peek cooly out at us from under the rim of the shell.

If the Spanish dancer, with its brilliant red coloration and large size was the beauty of the nighttime show, the hermit crab and anemone duets were definitely the clowns! **\$**

# A CHANGE FOR THE BETTER.



Next time you change your oil filter, there's something you might want to change with it.

Your brand.

Wouldn't it be smart to use the one that do-it-yourselfers prefer 3-to-1\* over the next leading filter?

One that's made to the highest specifications in the industry?

One that's been made by quality-minded experts for more than 50 years?

Yes?

Then it's time for a change.

To Fram.

Fram Division,  
Providence, RI 02916

\*Market Facts Consumer Opinion Survey



# BOLD...

# BUT BEAUTIFUL

**FATHOM DIVESUITS** features genuine **DURASOFT®**. The best divesuit material in the world.

This special patented foam-neoprene laminated to beautiful lycra spandex outside with a soft plush velour inside is an exclusive used only by **FATHOM**.

**FATHOM DIVESUITS** gives you top quality workmanship, exclusive materials and the bold exciting styles you've been looking for.

Demand The Best  
**FATHOM!**

For Suits: Dives (alt) Toll Free  
1-800-427-4800 FAX 1-800-412-5551

Photo by Jeff Hill



# Fathom

WRITE FOR OUR FREE CATALOG —

6500 S. ORANGE AVE. ORLANDO, FL 32809

# DIVESUITS